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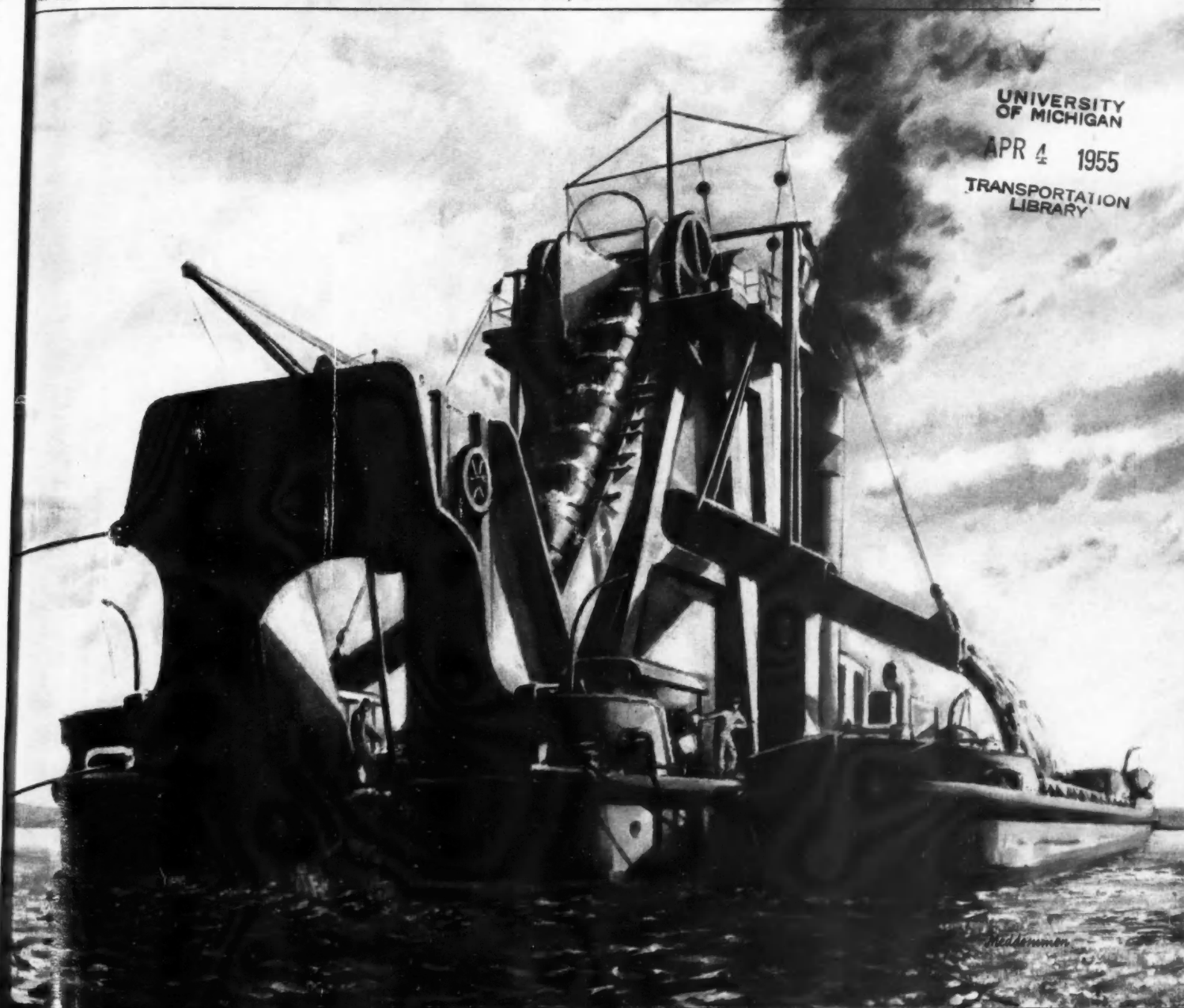
# Dock & Harbour Authority

No. 413. Vol. XXXV.

MARCH, 1955

Monthly 2s. 0d.

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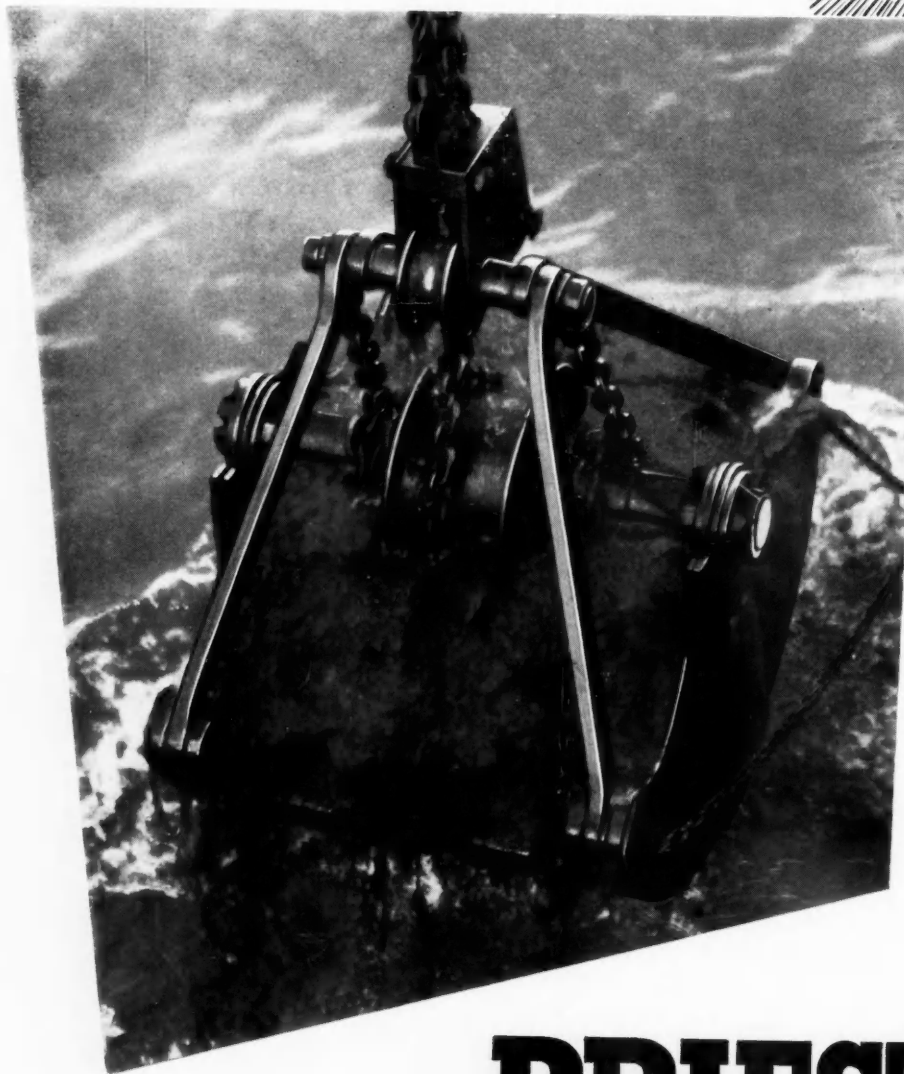
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# The Dock & Harbour Authority

An International Journal with a circulation extending to 83 Maritime Countries

No. 413

Vol. XXXV.

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## Editorial Comments

### Reconstruction of French Ports.

Port engineers frequently have to contend with peculiar problems which are outside the scope of normal practice or which cannot be solved off-hand. The deterring factors may be economic, physical, unusual phenomena, a new form of installation, or a combination of any of these. Such problems must be studied: colleagues may be consulted and research made into published books, and technical journals with the hope of finding accounts of similar problems and effective solutions. Sometimes this is a successful procedure which saves a great deal of time and expense: at other times the engineer is thrown on his own resources and, unfortunately, is not always able to achieve the end he desires.

This leads to a point worth making and that is the importance of wide dissemination of knowledge by the printed word, including the many specialised publications devoted to up-to-date records of present-day engineering practice.

In some countries, like France for example, engineers are encouraged to publish in the technical press records of their work, particularly of those cases where difficulties have been surmounted, or where unusual designs have been adopted or methods different to normal practice have been employed. The aim is not entirely for the advertisement value of establishing records of progress, so much as to provide authoritative and useful information to professional colleagues and the public.

Our esteemed French contemporary "Travaux" has done a great deal in this respect for the marine engineering profession by dedicating, during the years 1950 and 1954, four enlarged issues to the progress of the rehabilitation of the French ports, many of which, as the world knows, were destroyed or severely damaged during the Second World War. All contributions came from the engineers or managers engaged on the works of reconstruction in all ports, large and small. The range of subject matter was comprehensive and provided many interesting examples of ingenuity and engineering skill.

The record of their achievements indicates clearly and unmistakably the vitality of the French engineering profession and we are pleased to present in this issue a review of a few of the interesting papers contained in the 1954 issue.

### Proposed Development of the Port of Surat.

The State Government of India has recently announced its intention of developing Surat, in the state of Gujarat, into a modern port. Plans are in hand to provide a uniformly deep approach channel with an adequate anchorage and sufficient landing facilities. Last December, the Executive Engineer of the Marine Division reported to the Surat Chamber of Commerce that it is planned to build a jetty 230-ft. long by 60-ft. wide, while details of other phases of development are in process of being worked out by the Public Works Department in Bombay. A substantial sum of Rs. 32 lakhs has been allotted by the Government to be spent on these improvement works.

In view of its historical associations with the English East India Company, it is interesting to recall that Surat was the site of the first established English factory in India, and was one of its most

important sea ports and the chief commercial city. It flourished as the centre of the East India Company until the late 17th century, when Bombay was ceded to the Company and shortly afterwards made its capital and the seat of its trade. At the height of its prosperity Surat had a population of 800,000, but by the middle of the 19th century the number had fallen to only 80,000. It remained a centre of trade and manufacture, with cotton, rice and paper mills as its chief industries, but shipbuilding declined, and the port itself suffered from heavy silting.

### Ship Fires in Port.

The problem of combating ship fires and the need for closer collaboration between municipal and port authorities has often been ventilated in past issues of this Journal. It is interesting, therefore, to read the recently published Report on this problem, which the Association of Municipal Corporations has submitted to the Ministry of Transport. In this, recommendations are made concerning the organisation necessary for preventing fires on board ships in port, and the action which could be taken in improving efficiency in measures against outbreaks.

The Association formed a special sub-committee, consisting of town clerks and chief fire officers of 16 corporations under the chairmanship of the Town Clerk of Bristol. In its report to the Association the sub-committee comments on sections of the 1950 report on fire prevention and fire-fighting in ships in port, which was issued by the working party set up by the Ministry of Transport. It expresses the view that, while the working party's report focussed attention on the problem and was of value, it was a matter of regret that a representative of local authorities was not invited to join the party.

A number of the recommendations contained in the sub-committee's report have been accepted by the Association and forwarded to the Ministry in the form of a memorandum. One cogent suggestion is that each port and dock authority should set up a port organisation fire prevention committee, on which the local fire brigade is represented. Another is that responsibility for carrying out the recommendations of the Ministry working party should be placed fairly and squarely upon port authorities, shipbuilding and shiprepairing firms. Appropriate officers should be appointed by authorities and firms in accordance with the recommendations of the working party.

The Association set up its own small committee of chief fire officers for the purpose of reviewing information on fire prevention in ships in port. This committee, in considering the 1950 report to the Ministry, suggests that, if it was found impossible to obtain action by informal methods, then the possibility of introducing appropriate legislation should be considered.

The Association's report covers such aspects as welding, smoking, fires caused by stoves, electrical risks, outbreaks in accommodation and machinery spaces, fire patrols and appliances, alarm systems and standardisation of hydrants ashore, with adaptors for use by foreign vessels. It urges a revision of the paragraph in the Ministry report dealing with co-operation with public fire brigades to ensure that all outbreaks of fire are in fact reported to

**Editorial Comments—continued**

the local brigade either by telephone or pre-arranged alarm signal, by the ship's officer in charge, or by the official of the firm in charge of the vessel.

It is encouraging to see the municipalities giving a lead to the port and shipping authorities on this pertinacious problem of ship fires. It is only by the closest liaison and a speedy pooling of all available resources, that the dangers of fire can be minimised.

**Dock Workers' Conference in Amsterdam.**

Representatives of dock workers from Belgium, France, Holland, and Western Germany met under the auspices of the International Transport Workers' Federation in Amsterdam from 21 to 23 February last, to consider a joint policy for dealing with the social problems resulting from economic competition between the continental ports of the North Sea and the Channel region.

The conference agreed that more uniformity in the working conditions of the dockers of the different countries was essential in order to prevent unhealthy competition at the expense of social standards. Similarity in dockers' social standards would also facilitate co-ordination and integration of relations between the ports.

It was agreed that the unions represented would strive for a forty-hour week. The demand has to be reconciled with the needs of the industry, however, and the statement adopted by the conference recognised the principle of round-the-clock working and the shift system it involved. The normal working day shall fall as far as practical between the limits of 8 a.m. and 5 p.m. Week-

end work between 1 p.m. on Saturdays and 8 p.m. on Mondays shall only be permissible if it is confined to urgent work, subject to special agreement between the unions and the employers, and is included in the forty hours per week.

To meet the exigencies of port work, a shift system may be applied alongside normal day work, provided that it is limited as much as possible, that there is adequate compensation for work outside normal limits, and that a rest period of not less than twelve consecutive hours falls between two full periods of employment. Overtime shall be limited to exceptional cases, in order to finish a ship or to perform work of an emergency character, subject to a maximum of two hours.

The conference reaffirmed its faith in the principle of the decasualisation of dock labour, both as a matter of social justice and a means of promoting the efficiency of the industry.

During a discussion on the perennial problem of the economic rivalry between the North Sea and Channel ports the conference observed that unchecked competition is not only a threat to social standards, but harmful to the free flow of trade between nations. Whilst the economic and political unification of the region was recognised as the final answer, the conference urged that the problem can be mitigated by regional understandings directed at a sensible co-ordination of the ports and of the transport systems linked therewith. It called for more attention to this urgent problem in governmental and other quarters.

**Topical Notes****Recruitment of Australian Port Workers.**

At a meeting held on 17th February last, representatives of Australian shipowners, the Waterside Workers' Federation, the Australian Council of Trade Unions, and the Stevedoring Industry Board agreed to restore to the Waterside Workers' Federation the right to recruit port labour until the Australian Government has decided upon its long-term policy on port industrial conditions. The right of recruitment had been transferred to Australian shipowners under legislation passed in November, 1954, amending the Stevedoring Industry Act of 1947, but had not been exercised by them.

The new agreement is subject to the following conditions: port labour quotas are to be filled promptly as required, the names of prospective employees to be submitted by the Federation within ten days of any request by the shipowners; shipowners shall not reject employees so recommended except for bona fide reasons; in any cases of rejection, the final arbiter shall be the local representative of the Australian Stevedoring Industry Board.

**Radio-activity Experiment on Thames Mud.**

Radio-active ground glass has been used by the Hydraulics Research Station of the Department of Scientific and Industrial Research in collaboration with the Atomic Energy Research Establishment in a small scale experiment in the River Thames. The glass, containing radio-active scandium oxide, was injected into the river at Gravesend. The object of the experiment was to see if it were possible to trace the movements of mud on the river bed.

For some time it has been suspected that the dredged mud from the river channel and dock areas of the Port of London, most of which is dumped at sea beyond the estuary, is being carried back again up the river by the tide. It was difficult to prove or disprove the theory until the movements of the mud could be tracked in some way. "Labelling" the mud appeared to offer possibilities of doing this. The radio-activity could be detected by an underwater Geiger counter.

Any material put into the river had to behave as much like the mud as possible. Glass, ground so that its particle size was similar to that of Thames mud, was found to be suitable for the purpose. Scandium oxide was incorporated into the glass and the whole irradiated in the atomic pile at Harwell to form the isotope scandium 46 which is a suitable radio-active tracer.

Special equipment was necessary to inject the material into the Thames. It consisted of a drum with its ends spring loaded so

that they could be opened by pulling a release wire. Into this the scandium glass, mixed with river mud, was placed and the drum was lowered to the bottom of the river. When the ends were opened the water washed the contents out. The injection was done in mid-channel, at Gravesend, at low slack water.

Searches for radio-activity took place for several days afterwards, using Geiger counters in a waterproof container. The results showed that the method was a feasible one, although the grains of glass could not be followed while moving but only located when they were stationary on the river bed. Some of the material was carried at least two or three miles upstream in the first few tidal cycles. It is very likely that, on the fifth day after injection, some of it was 11 miles upstream and small amounts as far as 16 miles. The quantity injected in the river, however, was so small that no opinion about the movements of the mud could be based on these results. They prove only that the method is a possible one and can be used in a large scale experiment from which more conclusive information might be expected.

All stages of the experiment were monitored to see that there was no possibility of danger to health. There was no risk to the general public or to anyone working on or near the river. The radio-active material used in the test quickly became widely dispersed in the mud and so diluted that even if dredging operations were carried out in the area there would still be no danger.

**National Association of Port Employers.**

At the annual meeting of the National Association of Port Employers, held early this month, Mr. R. H. Senior (deputy-chairman and managing director of Port Line, Ltd.) was re-appointed chairman. Sir Leslie Roberts (chairman, Manchester Ship Canal Company) and Mr. T. M. Lawrie (chairman and managing director, Roxburgh, Colin Scott & Co. Ltd., Glasgow) were re-appointed vice-chairmen, and Mr. Leslie E. Ford (general manager of the Port of London Authority) honorary treasurer.

**Increase in Subscription Rates**

Owing to the recent heavy increases in printing and production costs, it has been found necessary to increase the subscription rates to this Journal.

Commencing with the new volume (No. 36), the first number of which will be published on May 15th next, the charges will be:—  
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# The Maritime Ports of France

## Progress of New Constructions

(Specially Contributed)

FOUR years\* ago the clearing of the wrecks and obstructions from the fairways of nearly all of the French maritime ports was in full swing, within the resources of the country's available plant; the priority programme of reconstruction and repair of the lesser damaged facilities was also being carried out with urgency. Simultaneously the designs for the overall projects for the complete modernisation of layout, equipment and new structures had left the drawing boards. In fact, there was a spate of professional activity directed to the end of rebuilding for France the most modern ports in the world on the full length of its coast line from Dunkirk to Marseille.

Since then a great deal has been done. The original designs have been modified and improved to suit post war trends, new materials and methods, and also in the light of experience gained in the progress of the constructions. The extensive works carried out in all the ports of France, from the smaller fishing to the larger liner ports, comprise several interesting and ingenious features well worth noting. The well known French technical publication, "Travaux," recognising the importance of these matters, dedicated two enlarged issues (April and May, 1954) recording the development in all French ports. The papers are contributed by the engineers in charge of the various works and are of wide practical value, as the following brief summaries show.

### PORT OF DUNKIRK

#### The Monitor Quay.

The Monitor quay on the west bank of the inner tidal harbour, just slightly east of the Trystam Lock, was totally destroyed in the hostilities. The old site was a shambles of rubble and twisted steel, and several wrecks cluttered the channel. In the shipyards opposite, on the east bank, a large new liner, the "Flandre," was being built and there was urgency to prepare a suitable mooring for the final fitting-out of the vessel. Besides this, the damaged state of the bank and its nearness to No. 1 dry dock (there was only an 80 feet width of sandy soil separating them) represented a source of danger claiming immediate attention.

The quay was therefore given a priority of reconstruction and was completed in time to accommodate the "Flandre." To accomplish this, a simple yet sturdy design (Fig. 1) of much greater stability than the old wall was decided on. The old wall was founded at -7.0 m. between datum, and the sea bed in front of it was at -4.20 m. level. The new wall was founded at -8.0 m. and the sea bed dredged to -7.0 m. The cross section shows a security curtain wall of Larssen IV steel sheet piling driven behind the remains of the old wall, and in front it, two lines of similar sheeting 5.20 m. apart driven to -12.0 m. and -13.0 m. respectively. In the space between these two parallel rows of piling, transverse bulkheads were driven at 60 m. apart, and these were again subdivided to three cellular compartments of 20.0 m. length.

The compartments were cleaned out to -8.20 m. and the bottom then blinded with a 0.20 m. layer of sand. Upon the latter was poured a mattress of concrete 0.5 m. thick to seal the base of chamber. The system of concreting used was that known as "Colcrete," in which the compartment was first filled with coarse aggregate (2½ to 5 inches), which had previously been thoroughly washed. The voids of the mass were then grouted with a mixture of cement and sand with a carefully gauged admixture of water, the special machinery, tubes and connections for this purpose having been placed beforehand.

To provide a substantial forward key or anchorage for the 1.0 m. thick concrete deck, rolled steel joists 10 x 5 inches section and 9.60 m. long were embedded in the concrete of the wall at 1.5 m. centres. The tops of the R.S.J.'s projected 0.85 m. above wall

top. The shore end of the deck was supported by 16 x 16 inches R.C. piles at 1.20 m. centres.

The quay of 210.0 m. length is equipped with 13 bollards, each rated at 100 tons pull. They are anchored back with reinforced concrete trusses as shown. Besides these, for exceptional weather conditions from the south-west quarter, there are six bollards, placed 40 m. distant inshore from the quay face, of 200 tons pull.

The whole quantity of cement grout used was fabricated on shore and pumped to the site, under the control of a central depot, at the rate of 18 cubic metres per hour. The maximum pressure reached was 450 lbs. per square inch.

#### Sea-lock Cofferdams.

Dunkirk has been particularly unfortunate with the entrance sea-locks to the wet docks. In 1939 there were three locks, one of which, the Watier, had been completed but had not entered into

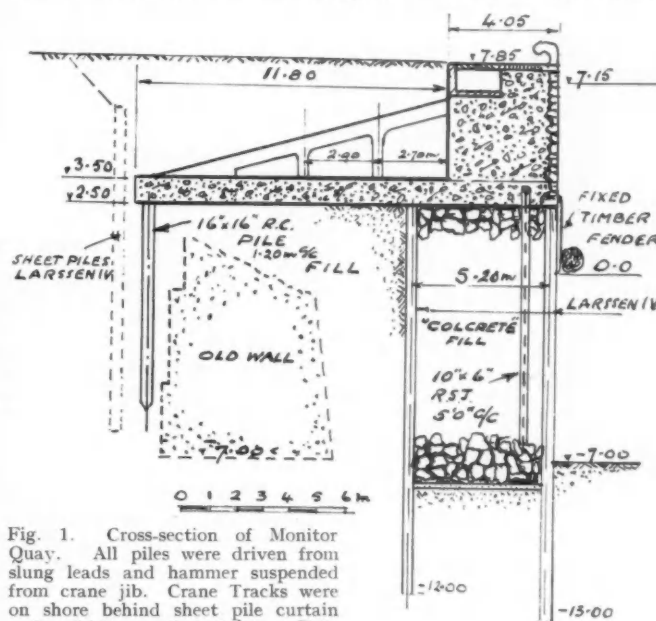


Fig. 1. Cross-section of Monitor Quay. All piles were driven from slung leads and hammer suspended from crane jib. Crane Tracks were on shore behind sheet pile curtain wall, which was first driven. R.C. piles supporting quay deck were driven after backfill was placed.

service. When the war finished all were unusable, and at the time of writing only one, the Watier, is in use. The outer entrance gate which leads from the outer harbour is subjected to severe storm action from the northerly quarter and is hazardous for shipping. To overcome this difficulty, studies for improvement are in an advanced stage in the National Hydraulics Laboratories. The need, therefore, for hurrying forward the repair of the more sheltered Trystam and the Guillaing locks was urgent.

As there was a large amount of under-water work, it was decided to use cofferdams and construct in the dry. The cofferdam type selected was of circular and part circular units, self stable throughout, for the locks, and also for docks Nos. 3 and 4 (see Fig. 2). For these circular units the sheet piles used were of Senelle Maubeuge pattern, a 10 mm. thick web of flat plate .406 mm. wide, with bulbous flanges (Fig. 3) connected together with clutches, as shown. A group of connected piles weighs 136 kilogrammes per square metre. The makers guarantee a clutch strength of 300 tons per lineal metre, which was confirmed by experience on the job. This type of sheeting has little lateral strength, but for curved construction it is most satisfactory in direct tension and,

\* See "The Dock & Harbour Authority," Nos. 360-1, Vol. XXXI., October and November, 1950.

## Maritime Ports of France—continued

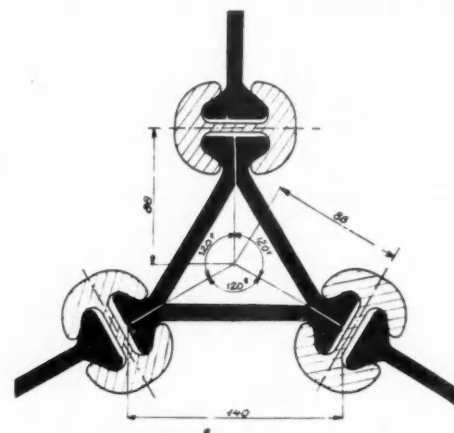
with the use of the patented triangular junction pieces shown, it is convenient and simple to place. After some extended experience on the jobs in hand, the engineers formed the opinion that a thicker section (12 mm.) would have been more suitable, and a greater use of completely circular units linked with circular arcs would have been more satisfactory than the straight bulkheads dividing the compartments. Another practical point which emerged during the works progress was that in the long run it was more economical to make the pile sheeting line template sturdy and rigid at the beginning; more particularly so when the sheeting may be subjected to agitated harbour waters whilst driving.

The diagrams of Fig. 4 show clearly the layout of the outer cofferdam. The radius 8.63 m. was used throughout, with the exception of the linking double arcs on the outside flanks of the circular centre unit, which were 10 m. and 12 m. radii. Although the deck level of the Monitor quay and the leading-in jetty was +7.45 m., the top of the cofferdam was carried to +9.30 m. to



Fig. 2 (left). Layout of Site of Trystam Sea-lock and Monitor Quay.

Fig. 3 (right). Section of Senelle-Maubeuge steel sheet pile, angular junction pieces, and clutches.



provide shelter from wave spray within the structure and to give added weight against wave action. All the compartments were sand filled, and the closure was effected at the leading-in jetty gap. The leading-in jetty was founded at -9.0 m. and, to avoid any scour that might undermine it, a line of Larsen IV sheeting was driven from the end of the cofferdam parallel to quay face, to depth -13.50 m., and terminating at the extremity of the jetty. To effect the closure, masses of clay were collected on the quay wall edge and at low water this was dumped between the curtain sheeting and the jetty, and finished to top level with sand. (See Fig. 5.)

### PORT OF BOULOGNE

This port is actually the most important fishery harbour of France and at long last it appears that the French Government has officially recognised the necessity of developing facilities so long needed and demanded by the township. Since the completion of the greater part of the needs of the cross channel tourist service, attention has now been directed to projects for the modernisation of the port facilities to suit the fishery industry. This will take the form of new quays with suitable equipment, fitting out and refuelling berths, marketing, packing and auction halls, maritime despatch station, and factories for specialised products.

#### Maritime (Tourist) Station.

Already the port engineers have done excellent work in the rehabilitation of the war-destroyed quays and installations, which

have not only been reconstructed to schedule, but have proved to be a great improvement on pre-war facilities, of neat and pleasing design.

The old destroyed Chanzy quay on the west bank of the River La Liane was an ungainly structure, but now that it has been replaced with a new quay and maritime station of reinforced concrete, it does credit to a great tourist port. The new construction comprises within a compact area berths for the main cross-channel services, passenger, fast goods and motor car traffic, a maritime station with platforms for nine rail tracks, car bridge ramp from vessel to quay, and all facilities for rapid handling and turn round of vessels. This year has seen the completion of the northern tip of this undertaking, which actually is the prolongation seaward of the Chanzy quay in a triangular spur accommodating mooring berth No. 13 for the car ferry on the west, and mooring berth No. 14 on the east, and is known locally as the "Eperon de la gare maritime." It is now in service (see Fig. 7).

The jetty is more sturdy than the old one, simple in construction and designed to take greater surcharge and heavier shock loads from vessels. It is entirely in reinforced concrete (Figs. 6 and 7), of which a greater part is pre-cast. It is founded on groups of

R.C. piles spaced 6 metres transversely and 3 metres longitudinally. There are two piles, 1.4 m. centres, to each group within the jetty and groups of two and three piles alternatively at the outside faces. The lower pre-cast longitudinal members resting on the pile caps are 1 m. by 1 m. section, by 9 m. long, and heavily reinforced with top and bottom steel. The vertical columns between these beams and the upper deck are 50 cm. x 60 cm. section spaced axially above all pile group centres inside the jetty. On the jetty faces the columns are triangular 1.6 m. per side heavily reinforced. The deck is formed of pre-cast slabs, shown solid, laid on the upper transverse beams of the truss and then covered with 0.65 m. thick concrete layer, which also covers the projecting joint reinforcement of the slabs and beams: diagonal members are provided for bollard stresses. There are four evenly spaced expansion joints.

The apex of the "Eperon" is completed as a triangular dolphin separated from the jetty. It is constructed of heavy steel H-beam piles bound together at two levels (+5.25 and +10.5 m.) by pre-stressed concrete deck slabs. The structure is linked up elastically with the jetty by four "Weydert" shock absorbers, two at each deck. These are rubber cased springs contained in heavy cylindrical castings; the piston ends and the cylinder ends are pinned to bracket bearings on the dolphin and the jetty respectively, with the axes of the twin sets opposing diagonally in the form of a V horizontally. Their use has been found satisfactory.

#### Gambetta Quay.

On the east bank of the River La Liane, directly opposite to the maritime station and the Chanzy quay, lies the site of the old Gambetta quay, mostly used by trawlers. The reconstruction of the southern end near the swing bridge is now proceeding as a provisional works pending the development of the main fishery extensions project. The methods used in construction and design are somewhat unique (see Fig. 8). It should be remarked that the

## Maritime Ports of France—continued

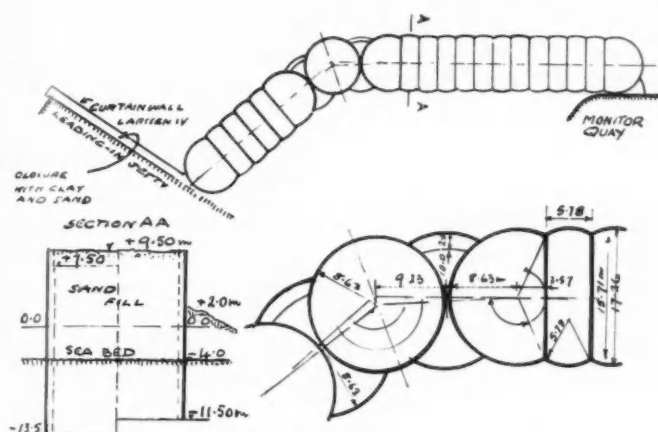


Fig. 4. Trystam Sea-lock Cofferdam at outer harbour end, between the Monitor Quay and the leading-in jetty. Note inset of centre circular unit and increased diameter of junction arcs on outer skin, and the lack of buttress at the jetty end, with the exception of the clay and sand fill in the closure gap.

sub-foundations are poor, and the bank behind the new works is choked with the remains of old quay-walls, and further, directions were given to the engineers that the work must be carried out with maximum economy. Thus the approved scheme comprises several unusual features, such as the following: (a) submergible cofferdam; (b) pre-cast concrete cantilevered relieving platform; (c) forward sloping pre-cast concrete slabs forming revetment to backfill; and an extremely light and narrow deck of pre-cast concrete at +10.50 m. level.

High water springs is at +9.45 m. and low water springs at +0.25 m. The river bed in front of the wall was -3.5 m. and is to be dredged to -4.5 m.

The execution of the submergible cofferdam was achieved by driving two lines of parallel Larsen IV sheeting 6.15 m. apart with transversal bulkheads at 20 m. centres. The toes of the sheet piles penetrated tuff to -8.00 m. with the heads at +5.0 m., that is, about half tide level. Inside the compartments the bed was excavated to -6.0 m. and blanketed with sand. When the tide fell to +5.0 m. level, the compartment was pumped out and concrete poured during the remainder of the ebb and the rise, until the water was near the top level +5.0 m. again. The work in the compartment ceased until the following half tide ebb, when the working shift recommenced. This method is not new to Boulogne. It was used successfully on the Chanzy quay five years ago and proved economical despite the flooding at each tide. The almost complete absence of walings and bracings internally allowed of more rapid progress than would have been possible in a dry cofferdam. At +2.65 m. level the top surface of the wall concrete was prepared to receive the pre-cast cantilever slab unit which had been cast about 2 metres short of its designed width, but with the reinforcement projecting at the front parallel strip section. This was poured *in situ* after registration of the slab.

Then followed the casting *in situ* of the counterforts, for which the reinforcement was built-up on the shore and placed whole in position on the slabs at 3.0 m. centres over the already cast in stickers. The forward sloping and the deck slabs were pre-cast concrete and were supported on the counterforts.

It will be interesting to learn how this design of the upper part of the wall behaves in practice, particularly during harbour ranging, or joggle, when some inconvenience may be caused to the trawlers alongside, whether broadside on, or fore and aft (*en épi*). It is a bold innovation for a tidal mooring.

## PORT OF ROUEN

## The "Rouen" Type Quay.

The extensive works of river training along the channel of the River Seine have not only improved the safety of navigation, but have also increased the capacity of the inland port of Rouen to accommodate deeper draught vessels.

The normal tidal range of the Seine estuary is about 8 metres, and at Rouen, 72 miles inland, it is reduced to 2.40 metres at H.W.O.S.T. and approximately 1.10 metres at H.W.O.N.T., varying, of course, with the weather and the condition of the river. With the improvements effected by the easements of the channel, it is now assured that vessels up to 9.0 m. draught will be able to use the port, and to that end the pre-war dredged level -3.0 m., Havre datum, of the river bed is now deepened to -4.50 m. for all new riverside construction. The high water level at the Rouen quays is +8.04 m., Havre datum, and the cope levels of quays are +9.60 m. to +10.00 m. For many decades the quays walls of Rouen have been constructed to a particular design, originated by the City's fore-runners and known the world over as the "Rouen type." For the given conditions, the suitability of the design cannot be challenged either for efficiency of service as comfortable berthing for vessels or general stability and economical maintenance as structures. Apart from slight variations, it can be described as a sturdy mass concrete wall faced with fair face masonry, proportioned height to base as 5:3; founded on a stout timber platform at about +3.00 (or about 3.00 m. below mean low water); the platform was supported, in its turn, on four rows of natural beech piles about 12 inches diameter. The face of the wall and the front three longitudinal rows of piles were battered at 1:10, but the fourth, and back, row was vertical. The line of the wall face was advanced into the river vertically above the toe of the revetted bank. The revetment was a blanket of chalk rock 2.0 m. thick covering the 3:2 slope of natural ground from low water to the river bed.

Behind the wall, vertical timber piles at 1.50 m. centres supported a stout timber platform at low water level. This spanned the gap between wall and bank and carried the back fill of the quay apron. Just above the top of the platform, stout steel tie bars connecting the wall to mass concrete anchorages in natural ground behind the quay were fitted at each bollard spacing. On the faces of the quays there were no fixed fenders or other protection against colliding vessels: entire reliance was placed upon care of navigation, the elastic design of the quay and the hydraulic braking effect generated by the squeezing out of the mass of water between the vessel's hull and the wall. It should be noted that this practice of the port has proved completely satisfactory over decades and is therefore continued to-day.

The post-war reconstruction has retained the main principles of the "Rouen type", but has modernised the methods and materials of construction in two progressive stages.

The first important modification was to replace the timber decking and the timber piles behind the wall by reinforced concrete, but preserving the relative levels and arrangement of the wall base, backfill deck and talus of rock blanket. The purposeful intention underlying this was to conserve the sectional area of the mass of



Fig. 5. View of Cofferdam after completion and dock pumped dry. In distance the new floating dock is moored temporarily at the Monitor Quay. To the right can be seen the circular arc cofferdam at the Freycinet end of the lock.



## Maritime Ports of France—continued

traffic were provided with central stretches of hand-laid paving stones with sand bottoming. The paving stones were satisfactory and stood up well to all loadings and shocks, but the cost of maintenance was heavy. It was easy to keep clean and was unaffected by destructive materials on the quay sides, such as fats, oils and acids. It was easy to lay between rails on quay aprons, no matter the section type of rails, and could be dug up and replaced without material loss.

The post-war position, however, with the introduction of various forms of mobile equipment with running wheels of small diameter, short lengths of chassis and small turning circles, found difficulty in negotiating uneven paved surfaces and forced the engineers to seek more suitable materials. Hence the rehabilitation of the port—which comprised extensive reconstruction of quays, sheds, roads and wider aprons to the quayside to accommodate road as well as rail traffic—added a new problem. In undamaged ports, where the sub-foundations had been consolidated by decades of use, a satisfactory change-over of road surfacing was not so difficult, but in Havre the reconstruction of the quays and remaking of badly damaged areas and roads requiring large amounts of new backfill was foreseen to present difficulties of economic importance, arising from uneven settlement. It was further appreciated that whilst the wheel loads of the majority of the vehicles would be transmitted on pneumatic tyres, and would not present difficulty in depth, the destructive action on the wearing course would be much more severe than on urban roads. Again, solid rubber tyres, although not so dangerous as those of metal, occasion considerable damage to the edges of concrete slabs or like material.

Other points considered were: (a) the circulation of fork-lifts in and out of the sheds implies haulages, accelerations, brakings and sharp turnings, which exercise considerable abrasions on the surfacing; (b) the use of tractors, frequently on tangential pulls, and the effects of repeated sliding and skidding are destructive to the hardest material; (c) the placing of heavy goods on skids to withdraw slings often leaves heavy imprints in the surfacing; (d) the spill of dirty material, such as fats, corrosives, acids and mineral oils, is frequently difficult to remove, and when pressed into the surface is susceptible of causing damage; (e) it is the custom in Havre to load imported heavy natural timber baulks on trollies fitted with iron wheels of small diameter. Since the loadings are up to 5 tons, there is greater intensity of loading on the surfacing than is usually allowed by the regulations; and (f) the use of automatic skips in the bulk storage areas likewise cause damage to the surfacing.

The sum total is that port traffic has more damaging effects on the surfacing of roads and areas due to shock, abrasion and spilling of corrosive materials, than on the sub-foundations or strength crust. Not only are the conditions of usage of port roads different to those of town or highway, but also the conditions of establishment: the form of the surfaces to realise; the difficulties of drainage; the conformation to other works, such as gullies to sheds, inspection manholes, shed ramps, rail trucks, loading platforms, service conduits, wagon hauling capstans and other equipment. Then there is the usual subjection to opening up trenches for various causes.

The consideration of these factors, placed alongside the many possible ways of using suitable materials, showed that it would be impossible to arrive at a satisfactory solution without actual full scale trial. The following brief descriptions show the results.

## Surface Carpets.

A most rapid and economical form of wearing course is a carpet of tarmac. It has been used for approach and main circulating roads, for which it has proved satisfactory. The rapid and continuous directional traffic, where there is little braking or turning, has the beneficial effect of compacting the material and transforming it into a veritable tar concrete; nevertheless, such a carpet must be watched closely to level up any defect immediately. When it has been used in sheds and on quayside aprons, it has not given equal satisfaction. Under a slow circulation the good effect is absent, the material remains relatively loosely knit and fragile. Such characteristics limit its uses to regular and continuous traffic for the best results.

## Concrete in Situ.

The use of *in situ* concrete for port roads and sheds has certain drawbacks, particularly over quay aprons and shed floors, where dust is to be avoided. It is subject to spalling at the joints and between rail tracks. It is objectionable at rail crossings, and difficulty is experienced in preserving continuity. It also represents considerable expense when deviations, additions or modifications of rail track or equipment become necessary. Even within the sheds it has been found to deteriorate quickly.

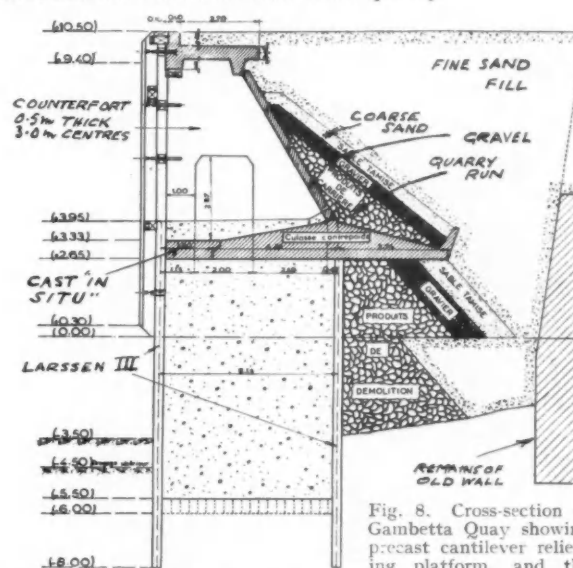


Fig. 8. Cross-section of Gambetta Quay showing precast cantilever relieving platform, and the novel arrangement of revetment of backfill. Sections cross hatched are precast. Note backfill grading.

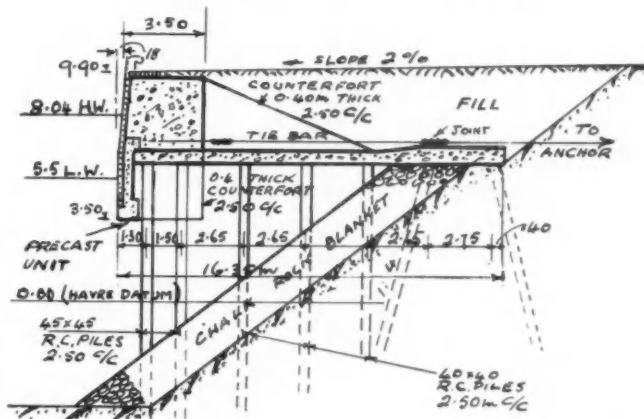


Fig. 9. Rouen. Cross-section of Modern "Rouen Type" Reinforced Concrete Quay. All construction done above water level in dry.

## Prefabricated Concrete Slabs.

It was decided to replace a defective *in situ* concrete area with prefabricated reinforced concrete slabs, whose manufacture was given close attention throughout; in particular, the edges and dimensions were scrupulously attended to, with the intention of effecting close jointing to ensure good resistance to spalling and corner cracks. The wearing surface had carborundum grains or metallic oxides incorporated to give greater resistance to abrasion. They were laid on the Herman Pasquier quay and gave some measure of satisfaction which, however, was offset by inconveniences and high cost. They were too heavy and required the constant attendance of a crane; they were also costly to unbutton for rail adjustment, etc.

To avoid these difficulties, smaller slabs of 45 cm. by 51 cm. by 9 cm. (18-in. x 20½-in. x 3½-in.) were manufactured with two

## Maritime Ports of France—continued

opposing edges designed to mesh in with adjacent slabs in the transverse course. They had a higher than usual percentage of reinforcement and the top edges were armoured with small angles to assure durable joints: the wearing surface was treated with steel dust. They did not give satisfaction, the joints were poor and the slabs were subject to movement under the traffic. They were also costly.

### Cement Macadam.

The failure to achieve satisfaction with *in situ* concrete led to experiment with what may be termed cement macadam, in which a washed aggregate is laid on a blinding layer of sand to the requisite depth, and then a grouting mix of cement and sand is poured to fill in the voids. The "Colcrete" system of mixture and method was used. This enabled slabs of 20 to 30 metres length to be laid without any trouble from shrinkage or expansion. The results, however, were not uniform. This may have been due to lack of constant skilled supervision to ensure the correct mix

An even more satisfactory procedure, after compaction of the sub-foundations, was to pour a 3½-in. thick concrete slab reinforced with two-way steel wire fabric, and whilst still green, to tightly pack salvaged broken paving stones on the surface to form a total thickness of about 7½ inches: the joints were then grouted with a liquid cement mortar, brushed in thoroughly. The use of a vibrating appliance will help compaction and secure a regular surface without the need of expansion joints. Using this method, a continuous run of 100 metres was laid on the Rhin quay for coal storage with very satisfactory results.

### Tar and Bitumen Coated Materials.

Open textured carpets of this material have several drawbacks to their use in port work. They are not sufficiently resistant to quayside shocks, the manoeuvring of tractors: they are pervious to the weather, and the accidental spill of liquids and materials. This inconvenience can be easily overcome by the use of a dense material laid hot, which immediately after rolling becomes thoroughly compacted. In Havre, binders of feeble penetration (80/100 or 180/200) were found to be suitable and amply resistant to come into use soon after laying without hurt.

It did not appear that the quality of aggregate exercised any definite influence on the resistance of a dense crust. What seemed to be of most importance was that the material used should absorb the binder easily with good adhesion and, furthermore, should be laid by experienced workmen who know exactly what has to be done to obtain correct results. Casual labour is useless and costly in the long run. This dense carpet, whether of bitumen or tar, gives excellent results when the sub-foundations are reliable and there are straight and parallel continuous runs of considerable length.

The extensive length of the Hermann du Pasquier quay was laid with a dense textured carpet of 2 cm. thickness and has given satisfaction, as shown in Fig. 10.

R. R. M.

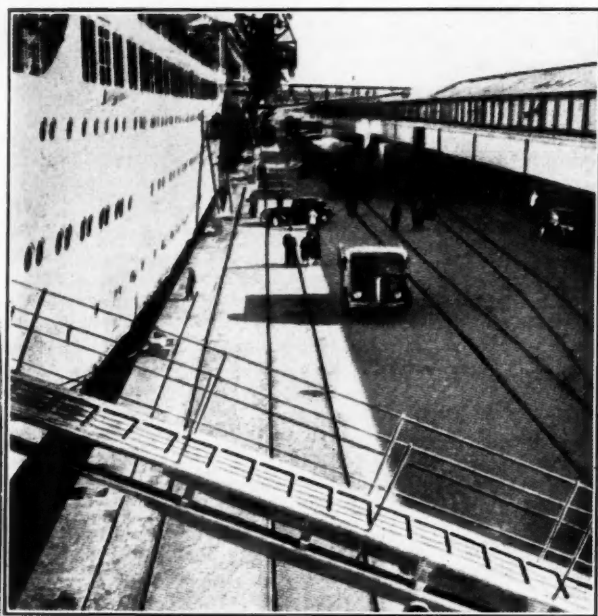


Fig. 10. Le Havre. Hermann du Pasquier Quay relaid with dense bitumen carpet.

and also some laxity in the continuity of pouring. Some interruptions also occurred due to other works in progress, and some patches had to be by-passed temporarily and were done later. This caused fine fissures which were, nevertheless, weak points of the finished crust. The surface had good resistance, but was not so uniform as *in situ* concrete. A large area on the Joannes Couvert quay between two sheds was treated in this manner and behaved well, yet it is doubtful whether it warranted the extra expense.

### Paving Stones on Sand, Jointed with Bitumen.

This type of surface proved satisfactory in places where a continuous run of rigid revetment was inadvisable, such as over recently placed backfill in quay aprons, which although rolled and tamped had not had time to reach full settlement. For this make-do temporary arrangement it is economical.

### Paving Stones on Sand, Jointed with Cement Mortar.

This type was laid similar to the above, but only over well compacted sub-foundations. It was rigid and resistant. For coal storage areas where automatic jaw grabs were in use, good results were obtained. The sub-foundation was covered with 10 cm. of clinker or slag and 8-10 cm. of sand, on which 4-in. deep cobbles were laid and bedded about one-third of the joint depth in sand, the remainder of the depth being grouted in cement mortar.

## Obituary

### Dr. Herbert Chatley

We regret to record the death, on January 17th last, of Dr. Herbert Chatley, who was a regular contributor to this Journal.

Herbert Chatley was born on May 17th, 1885, and received his technical education at the Northern Polytechnic. In 1906 he obtained the degree of B.Sc. (Eng.) of London University.

On the completion of his training, Dr. Chatley secured an appointment as lecturer in civil engineering at the Portsmouth Municipal College, and a year later went to China as Professor of Civil Engineering in the Chinese Government's Engineering College at Tongshan. He retained his professional chair until 1915, when he joined the Nanking-Hunan Railway as assistant engineer, soon afterwards becoming district engineer with responsibility for several hundred miles of the system.

His next appointment, in 1916, was as assistant engineer to the Whangpoo Conservancy Board, whose duty was the maintenance of the navigable channels of the Whangpoo River, a tributary of the Yangtse Kiang. He held this position for 12 years, eventually succeeding to the office of Chief Engineer, from which he retired in 1937. He made an exhaustive study of the behaviour of silt and river mud, a subject on which he became an accepted authority, and on the methods of maintaining dredged channels. After his retirement, he returned to London and went into practice as a consulting civil engineer, acting for the Whangpoo Conservancy Board and for other navigational authorities. One of his most important undertakings, in this connection, was to supervise the design and construction of a large drag-suction dredger, the Fu-Shing. In 1940, he joined the Civil Engineering Department of the Admiralty, where he was intimately concerned with the construction of the Mulberry Harbour for the Normandy landings of the Allied armies.

Dr. Chatley was a member of the Institution of Civil Engineers and of the Institution of Civil Engineers (Ireland); a Fellow of the Physical Society and an Associate of the Institute of Physics. The University of London conferred upon him in 1914 the degree of D.Sc. (Engineering).

# Cathodic Protection of Steel Piled Wharves

## Description of Installations at Lae, New Guinea\*

By L. T. RYAN, B.Sc.

(Concluded from page 307)

### (8) General Design Details:

The design finally adopted specified that a current of 1050 amp. was to be applied to the wharf for a period of 14 days, after which it was to be progressively reduced to 105 amp. The twenty-two anodes were to share the current in the proportions stated in Table II, which also shows the minimum weights and surface areas required for the anodes.

TABLE II

Anode group.	Design current per anode.	Surface area.	Weight.
1	54 amp.	8 sq. ft.	600 lb.
2	50 amp.	7 sq. ft.	600 lb.
3	54 amp.	8 sq. ft.	600 lb.
4	26 amp.	3.3 sq. ft.	330 lb.

It was anticipated that the anode currents might have to be adjusted to these values by the use of fixed series resistances in some of the anode leads.

The rectifier selected for use was a modified 25-kVA 3-phase S.T.C. standard electroplating unit. This rectifier has a maximum direct current output of 1,500 amp. and the voltage is capable of adjustment between  $\frac{1}{2}$  and 12 volts in 36 steps. The unit was fitted with an A.C. ammeter, a D.C. voltmeter and a D.C. ammeter. It was designed to operate in the tropics and was protected by a thermal overload relay.

Details of the layout of the anode leads and bus bars and other cable are shown on Fig. 10. The temporary bus bar of two strands of 37/083 insulated copper cable was necessary to reduce the IR losses to the more distant anodes during the application of the high initial current.

### (9) Installation of Anodes:

The anodes used at Lae were chunky pieces of cast iron and steel with an average weight of 900 lb. They were very variable

in size and shape and were arranged in groups of roughly equal size to simplify their adjustment to the correct current by the use of resistances. The anodes in groups 1 and 3 were engine blocks and large pumps with a surface area of approximately 27 sq. ft. and an average weight of 1,200 lb. Those in the remaining groups were doughnut-shaped pieces of cast steel with an average weight of 500 lb. and a surface area of 8 sq. ft.

The anode connections were prepared as described and the anodes lowered by means of a mobile crane into the appropriate positions under the wharf. A diver then arranged the anode lead along the sea bed to the nearest pile and fixed it to the pile at the mud line. Fig. 11 shows the preparation of the anode connection on an anode typical of those used in groups 2 and 4.

### (10) Initial Treatment of Wharf:

The initial treatment was started on 10th September, 1953. The potentials of the piles before the treatment were measured and found to be uniformly  $-0.55$  vol. There was no variation of potential with depth. However, at the time of measurement the layer of fresh water from the Markham River which was expected to cause such a variation, was a long way from the wharf.

A current of 1,250 amp. was applied; this is in excess of the design current of 1,050 amp. but it was decided to apply a higher current because of the large anodes in groups 1 and 3. These anodes would result in a more uneven current distribution than that allowed for in the design—the variation in current density between the nearer and the more distant piles being greater the larger the anodes. It was necessary to apply 6.8 volts to give a current of 1,250 amp. and 5.7 volts for a current of 1,050 amp. The model tests predicted that a total voltage of 5.5 would be necessary for a current of 1,050 amp. This good agreement further justifies the model technique.

The currents were distributed between the anodes as shown in Table III. As was expected, the larger anodes in groups 1 and 3

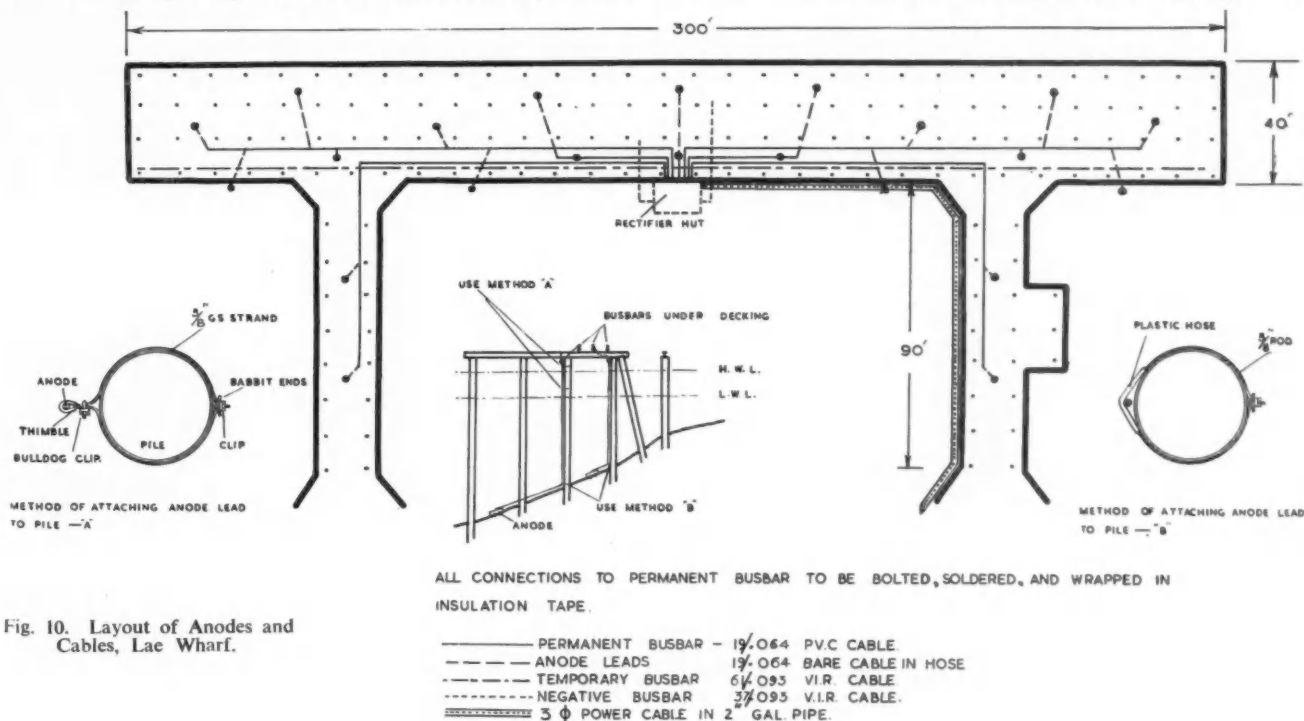


Fig. 10. Layout of Anodes and Cables, Lae Wharf.

## Cathodic Protection of Steel Piled Wharves—continued



Fig. 11. Preparation of Anode Connection at Lae.

received a very high current. This was corrected by placing a resistance of 20-ft. of 7/083 bare copper cable in series with the lead to these two groups.

TABLE III

Anode group.	Average current per anode.		Design value.	
	Without resistance.	With resistance.	at 1050 total current	at 1250 total current.
1	83 amp.	68 amp.	54 amp.	64 amp.
2	45 amp.	52 amp.	50 amp.	60 amp.
3	82 amp.	69 amp.	54 amp.	64 amp.
4	27 amp.	29 amp.	26 amp.	32 amp.

The potentials of the wharf piles rose rapidly to  $-1.0$  volts soon after the treatment started, those on the deep side of the wharf being appreciably lower than those on the shallow side. The reason for this was that the under-mud portions of the piles were receiving a much smaller proportion of the current than that assumed in the design. As the depth of penetration of the piles into the mud was fairly uniform, this effect was greater for the piles in shallow water than for those in deep water.

The increase in current density as the shore is approached is also borne out by the fact that the calcareous deposit that appeared on the piles after the first day's treatment was more pronounced on the approach piles than on those in the deep water. The calcareous deposit was considerable at the end of the period of initial treatment and extended up the piles to within 8-in. of

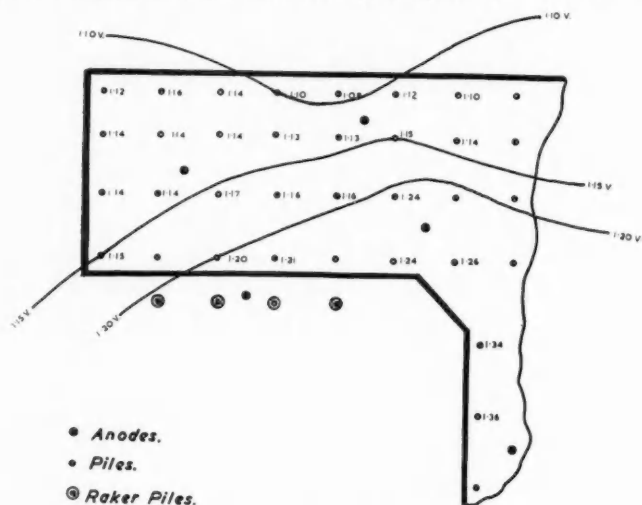


Fig. 13. Potential of Piles and Potential of Contours of Wharf on the seventh day.



Fig. 12. Showing the Rectifier Hut and the Calcareous Deposit on the Piles.

the high water level. Fig. 12 shows this deposit on the piles in the inter-tidal range.

It was not possible to disconnect the piles and measure the current density to them as was done in the scale model tests. However, some indication of the current density distribution is given by the potential measurements of the piles. Fig. 13 shows the potential readings of piles in a section of the wharf taken during the 7th day of the initial treatment. The readings for this day show no tendency to be higher for the piles adjacent to the anodes, the main trend being for the potential to become higher as the shore is approached. Earlier readings showed that there was a variation in the current density after the pattern predicted by the model test, but this was apparently quickly evened out.

It appears, therefore, that the distribution of the anodes is not as critical as was at first thought. Even if some piles get a higher than average current density, initially they will become more polarized, which would result in their current density being reduced.

The potential-time curve for a typical position on the wharf is plotted on the graph in Fig. 14. The method and apparatus used for measuring the pile potentials is shown in Fig. 15.

The A.C. power input for the 14-day initial treatment period was 12.6 kW and at 3 pence per kilowatt-hour would cost £53.

## (11) Maintenance Treatment:

The current was reduced to 170 amp. (9.7 mA per sq. ft.) on 24/9/53. This current required 1.8 volts with an A.C. power input of 404 watts.

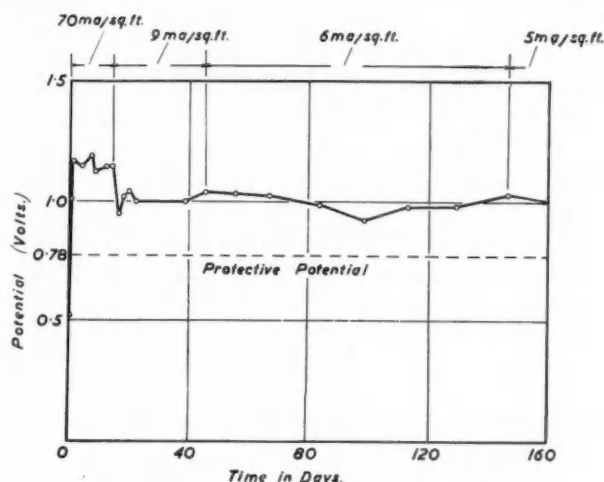
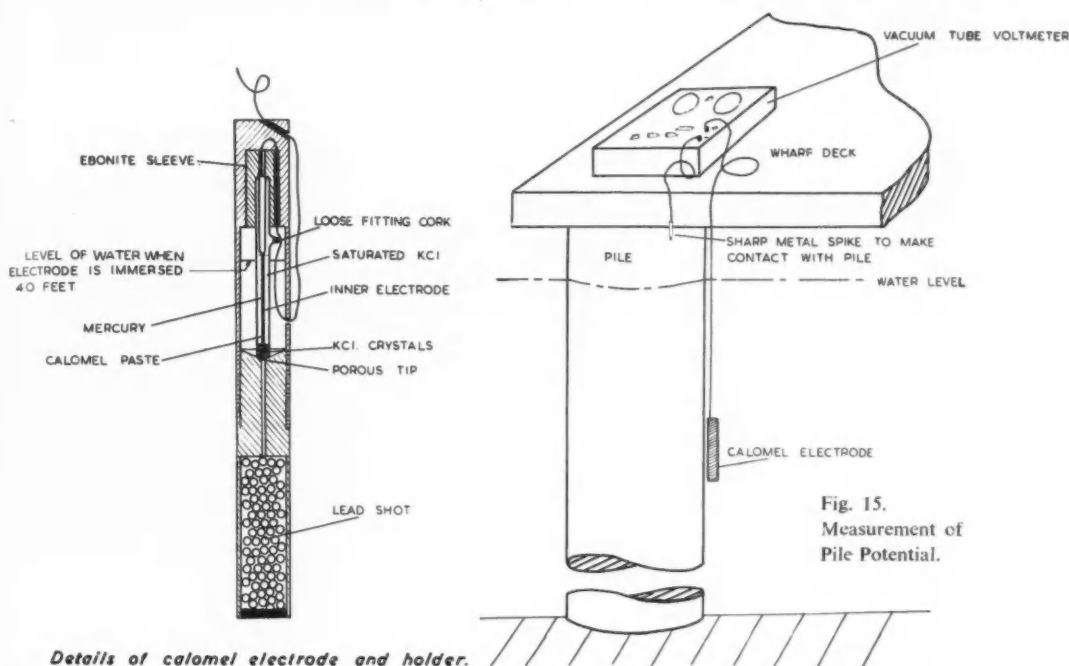


Fig. 14. Potential Time Graph for Wharf near Rectifier Hut.

## Cathodic Protection of Steel Piled Wharves—continued

Fig. 15.  
Measurement of  
Pile Potential.

bring the running cost of the installation to about £240 per year.

## Design of Future Installations

The model tests for the Lae wharf were intended principally to decide the necessary applied voltage and the anode pattern for an even current distribution. A general equation has been developed for the calculation of the resistance of anodes, and experience at Lae has shown that the anode distribution is not as critical as at first thought. It is unlikely, therefore, that the future protective systems for the other steel wharves will be designed by the use of scale models.

The potential of the position of the wharf near the rectifier hut dropped from  $-1.15$  volts to  $-1.08$  volts in the first four hours and continued to drop slowly until it reached a steady value of  $-1.0$  volts on the 24th day. The potentials of the other parts of the wharf behaved in a similar manner. The values of the potential of the wharf were much higher than that required for protection ( $-0.78$  volts). The current was reduced to 125 amp. on the 46th day and to 105 amp. on the 100th day. These reductions had little effect on the wharf potential. It is therefore apparent that the current density can be even further reduced and still maintain full protection.

Table IV shows the distribution of the protective current between the anode groups with a total current of 125 amp.

TABLE IV

Anode group.	Actual current.	Design value.
1	37 amp.	39 amp.
2	36 amp.	36 amp.
3	35 amp.	38 amp.
4	17 amp.	13 amp.

## (12) Effectiveness of Cathodic Protection in the Inter-Tidal Range:

This important factor could not be measured directly; however, it was noticed that the calcareous deposit formed during the initial treatment period extended for two-thirds of the way up the intertidal range. It is expected, therefore, that the protection will be effective in this region.

The calcareous deposit was inspected on the one-hundredth day and found to be in an apparently unchanged condition. No corrosion of the piles had occurred in the region covered by the coating.

It is intended to paint the upper portions of the wharf with a quick drying protective coating. Tests have shown that if this coating is applied during the low tide period it can satisfactorily protect all of the piles above mid tide. As the effective zones of the two protective systems overlap, it is possible to protect fully the whole of the wharf against corrosion.

## (13) Cost of Installation:

The cost of installing the protective system to the Lae Wharf was approximately £3,000, excluding the necessary experimental and design work.

The cost of installing the twenty-two anodes was approximately £800, and as the estimated life of the anodes is five years, the yearly charge for anode replacement would amount to £160. The additional charges of £50 for power and £30 for inspections would

A design procedure similar to the one outlined below will probably be followed in the future:—

## (1) Selection of Number of Anodes:

This would be influenced by the type and size of scrap iron or steel available. The number should be sufficient to:—

- Give an anode life of at least six years at a current sufficient to give a current density of 5mA per sq. ft. of bare steel.
- Ensure a reasonable current distribution to various parts of the wharf.
- Ensure that the required applied voltage is reasonable.

## (2) Calculation of Applied Voltage Required:

Experiments in this laboratory have shown that, for a wide range of anode shapes and sizes, the resistance of an anode is inversely proportional to the conductivity of the water and the square root of the anode surface area. The expression developed was:—

$$R = \frac{0.07}{P} \sqrt{\frac{A}{A}}$$

where  $R$  is the resistance of the anode in ohms.

$P$  is the conductivity of the water in mho cm.

$A$  is the surface area of the anode in sq. in.

Table V shows the experimental verification of this equation.

TABLE V

Anode shape	Dimensions	Conductivity of water mho cm.	Resistance—ohms.	
			Calculated	Determined
(I) Laboratory Tests.				
Cylinder	0.23-in. dia. x 2½-in. long	0.0009 0.000186	113 520	104 486
Flat Disc	0.94-in. dia. x 0.034-in. thick	0.00047 0.00028	210 355	214 346
Cube	½-in. x ½-in. x ½-in.	0.00047 0.00028	216 377	214 366
Prism	1-in. x ½-in. x ½-in.	0.00047 0.00028	201 342	196 334
Sphere	0.625-in. dia.	0.0075	73	73
(II) Field Tests.				
Lae Anode No. 1A Pump Part	5-ft. x 1½-ft. x 1-ft.	0.038	0.061	0.057
Lae Anode No. 2B Thick Disc	Area 9.2 sq. ft.	0.038	0.089	0.099
Point Cook Anode No. 3 Cube	Area 1.05 sq. ft.	0.040	0.30	0.27

(Concluded on page 334)

# Industrial Television Developments

## Potential Uses in Docks and Harbours

By LEO WALTER, A.M.I.Mech.E., A.M.I.Plant.E.

**M**ARITIME operations were the first mobile service to which radio was applied. Communications from ship-to-ship, and ship-to-shore, for harbour craft and others now make use of simple radio-telephony transmitters, usually with built-in receivers. The communication needs of harbour tugs and other small craft working within short distances of their directing stations are met by fixed-frequency V.H.F. transmitter receivers, as simple to use as an ordinary telephone. These advances have been followed by television transmission by means of micro-link waves, and more recently by wired television aboard ship, and ashore in dock and harbour establishments. In the following article a few recent developments will be described.

Wired television is a relatively simple new development, but it took the British television industry several years of research to build small-size lightweight cameras and compact power units with fewer electronic valves, and fewer components than used in the public television system. The result of these developments should be of great interest to dock and harbour managements.

### What is Wired Television?

Wired television is electronic communication equipment, usually consisting of three units, namely a special camera for taking images of remote happenings, a power unit, and a receiver or viewing monitor with screen, similar or identical with standard television receivers. These basic units are linked together by co-axial cables, hence the term "wired" television. Such a system is fully independent from public broadcasting or television, and is in itself a complete television station, to which sound broadcasting with loudspeaker can be added if required. The receiver or monitor obtains its visual signals from the closed circuit wiring system. In modern cameras for I.T.V. the number of electronic valves has been reduced to say 17 or 20 valves, as against hundreds in conventional public T.V. systems, but nevertheless sharp images are received in reliable continuous operation on one or several monitor screens.

Generally speaking the use of wired television originated in industry, where direct observation would be too difficult, too dangerous, or too exhausting. The electronic "eye" of the I.T.V. camera can literally see around the corner, and can be located in places where a human observer could not stand long, if at all. The

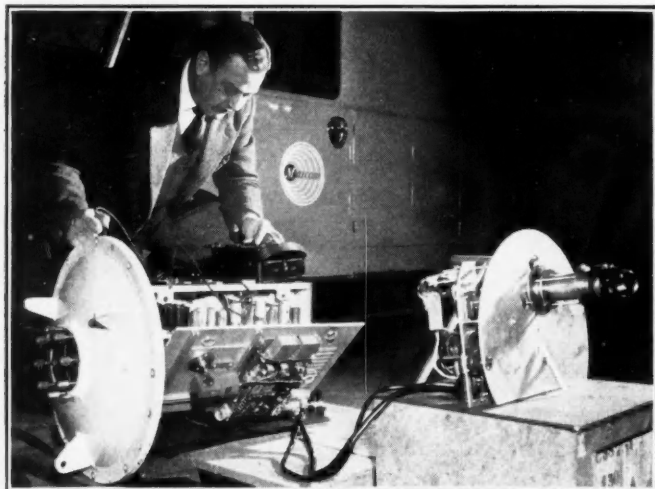


Fig. 1. Underwater Television Camera removed from its watertight, pressure-resisting case.

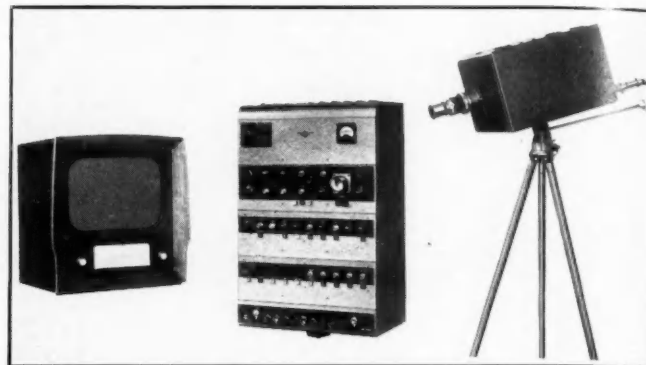


Fig. 2. Emitron Industrial Television Equipment.

power industry in America has been the proving ground for special applications, such as the viewing of oil burners in boiler furnaces to guard against loss of ignition, or to observe boiler water level of very large steam boilers. Experience gained in power plant applications has been helpful in developing uses for television in other branches of industry. With the help of industrial television, dangerous operations can be controlled remotely, thus avoiding the hazards of direct visual supervision. Control of large scale operations involving observation by individuals at remotely located points has been centralised in the hands of one person, who now, through the eyes of the television camera can view several widely separated points simultaneously.

Because television probably represents the most advanced form of communication, it is quite naturally presumed to be complicated, but, in fact, its principle is comparatively simple. It seems paradoxical that the human eye does not look at a television picture although it sees one. The explanation is that the eye, since it cannot follow the rapid deflection of the electron beam which "paints" the television picture on the screen and provides picture information by variation of intensity, sees only the final effect of the beams travel. Basically, a television picture is produced segment by segment, just as letters are typewritten across a page, but the process is so rapid that the human eye sees only the finished product.

### Brief History.

The history of television in general, and of wired industrial television in particular commences as far back as 1873 when Cary made the first step by the discovery of the photo-electric property of selenium. Gradually the difficulties have been overcome for producing pick up devices with sufficient sensitivity to operate under normal lighting conditions. Techniques developed during the Second World War culminated in design of the Image Orthicon tube and camera, and of the Vidicon camera. Industrial television using a closed wiring circuit required a complete reversion from the field of entertainment in order to produce a new unique technological tool for management or engineers. The main fields which show appreciation are mechanical handling operations, visual inter-office communications, time and motion studies from remote observation points, remote telemetering of indicated values on instruments, inspection without being noticed, and many others. Security and law enforcement, control of road and railway traffic, underwater work, rescue operations, and supervision of work on ships and docks can be done faster, safer, and more economically by using wired I.T.V. than by conventional methods.

Of interest to dock and harbour authorities is the adaptation of I.T.V. for underwater use. The underwater television camera has

# Industrial Television Developments—continued



[Courtesy Pye Ltd., Cambridge]  
Fig. 3. Lowering under-water camera into sea.

gone to far greater depths in the ocean than a diver can descend with safety. Recently the Marconi-Siebe-Gorman underwater television camera has been fitted with a new periscopic lens which is controlled remotely from the ship above and can be made to "shoot" in any direction within a hemisphere whether the camera is moving below the surface or not. It overcomes many of the difficulties of televising underwater when weather conditions are poor and the apparatus is swinging with the tide, and allows the camera to scan a large area of the sea bed without having to move it either from above, or with the aid of a diver.

Under operational conditions, further uses for underwater television of special interest to dock and harbour authorities are the study of wrecks, examination of submerged objects and investigation of the sea bed. Other uses are the observation, identification and supervision of oyster and scallop beds, and the inspection of dock gates and ships below the water line.

The Comet disaster near the island of Elba in Italy was another opportunity for the underwater camera to prove its worth. Amongst the special cameras flown to the spot where the aeroplane was suspected was a Pye underwater camera. The deep sea television equipment, made by Pye Ltd., of Cambridge comprises a combined Camera-Control unit, and synchronising pulse generator. The camera is intended for operation down to a depth of 3,500-ft., and the container withstands a water pressure of 220 lbs./sq. in. corresponding to 5,000-ft. depth, thus giving a good safety margin. A complete Pye equipment has been installed in the deep diving vessel H.M.S. "Reclaim" for special uses.

The same firm has also installed its industrial wired equipment for I.T.V. aboard the whaling factory ship "Balaena." The whales are fed into the stern of the ship and the miniature television camera is so installed that after the initial camera adjustments have been carried out the camera can be left entirely unattended. This camera is to be used to relay pictures on a closed circuit—over 750-ft. of cable—to a monitor specially installed on the bridge. During the short whaling season whales are brought alongside at a steady rate. In addition to the delivery of whales, other ships in the fleet of 19 vessels may come alongside to take on stores or replenish their stocks of harpoons, each of which weighs over a hundredweight.

The control of all these manoeuvres from the bridge has always been difficult as the distance between the bridge-house which is well to the forward, and the aftercastle, which is well to the stern, is 500-ft. Moreover, the view is obstructed by two large funnels. As both whales and ships tie up to the stern, the problem of controlling these manoeuvres is an acute one. By setting up a television camera it is hoped to obviate most of the difficulties and

also to ensure that a maximum efficiency and a minimum of time in handling the whales is achieved.

The entire equipment for the generation and control of the television image in the Pye equipment is contained in a single camera case measuring only 16.3/8 x 6.1/8 x 14-in. A high definition 14-in. picture monitor is connected to the camera via a single co-axial cable, and distances up to 1,000-ft. can be covered.

In docks and harbours a multitude of mechanical handling and transport operations are carried out. Control of materials handling ranges from supervision of very large cranes to control of trucks for loading and unloading. Two recent developments showing the potential use of television for this work are therefore of interest. The first was in London, where the movements of a fork-lift truck were televised at the 1954 Mechanical Handling Exhibition at Olympia, by means of closed-circuit T.V. equipment.

The second was in the U.S.A., where experiments in the supervision of shunting by remote control were carried out. The illustration (Fig. 5) shows the picture on the monitor screen and clearly reveals the box car number on the image.

For this experiment a Du Mont field-type image-orthicon camera chain was employed. This equipment is of the type used by broadcast television stations for remote pick-up of outdoor events. Several days of testing at the classification yards at New Haven showed that the equipment could satisfactorily perform all the operations enumerated above. Box car numbers could be read easily, not only in the daylight but also at night with only the simplest of lighting equipment.

The ability of the Image Orthicon to resolve small details of an object in motion under low ambient lighting proved to be a very necessary qualification and one that some other types of television designed for industrial use could not pass. The equipment described was mounted temporarily in the yard-master's office, and all tests were viewed on the high-quality monitor, of the type used in broadcast studios.

For a test of ability to show enough detail to control classification procedures the camera was mounted on a pole about 20-ft. high. The resulting view of the tracks was of sufficient detail to assure the railroad that the application was practical.

Observation of cranes, of conveyor bands, of elevators and lifts can similarly be performed, from a centralised control point, which saves time and effort on part of a loading or unloading supervisor, or of a despatch clerk.

It can be visualised that in the not too distant future the railway signalling system will use wired coloured television. New small special cameras are now being developed in England which show natural colours on monitor screens. Stationary cameras at strategic points on the railroads can check movement of trains, of signals, and of signal panels in signal boxes. These images could



[Courtesy Pye Ltd., Cambridge]  
Fig. 4. Whaling factory ship "Balaena," showing specially constructed cabin housing television camera.

## Industrial Television Developments—continued



[Courtesy Allen B. Du Mont Laboratories, Inc.]

Fig. 5. Monitor screen showing clearly the number of a railway truck.

be collected in a central point where a supervisor could at any time use pictorial first-hand information for checking and controlling traffic safety.

Some actual recent installations in inter-office communication suggest that visual and audible equipment might have a future, for example, in customs clearance in ports and harbours. In dock warehouses it has been suggested that a concealed I.T.V. camera can help to detect theft and burglary. Finally an internal T.V. system with telephone between one department and the next in a dock building and in a remote branch could be used to "flash"

copies of documents which are urgently required, instead of having them sent by messenger. Banks have already made use of I.T.V. for checking signatures on cheques, and the like between remotely located branches and head office.

There is another interesting device which may find uses in docks and harbours. It is the "Walkie-lookie" equipment developed by Radio Corporation of America (RCA—Photophone Co., Ltd., of London) which enables patrols to send direct to a control room on the spot information with pictures. Similarly roving traffic officers can report and show what is going on on roads. This unit has been developed by R.C.A. of New York as a lightweight transmitter and receiver set complete with hand camera, lens-turret, microphone and antenna system, operating over half a mile from the control station.

Summing up, the use of I.T.V. in shipping and in dock and harbour operations has great potentialities. The day may come when ocean-going liners as well as smaller boats will soon be docking with the aid of television cameras appropriately positioned in the bow, stern, port and starboard, to give pictures, on the bridge and in the engine room, of the wharf, tugs, tow-lines, and other equipment associated with the berthing. During loading and unloading cargo, the hatchman guiding the winch operator may be replaced eventually by a television camera. Cameras positioned in holds of ships will enable constant check on cargoes susceptible to fire outbreaks. Combined with infra-red light fire-fighting aboard ship will also be aided by wired television. Television will also have applications in canals and locks, in dry docks, and on bridges that open for river and harbour traffic.

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## Cathodic Protection of Steel Piled Wharves

(Concluded from page 331)

The foregoing expression gives the resistance of the anodes when first installed; this will, of course, increase as the anode is consumed by the passage of the protective current. The initial anode resistance should be low enough to ensure that the applied voltage is reasonable during:—

- (a) The pre-treatment at the high current density.
- (b) The latter part of the life of the anodes.

The calculation of the applied voltage by this procedure is valid only if the ratio of the anode to cathode area is 1 : 100 or greater. This would normally be the case unless the structure is covered by an anti-corrosive coating in good condition.

- (3) Placement of Anodes:

If the anodes are placed according to the best geometrical distribution and the ratio of the distance from them to the nearest and most distant pile is no greater than 1 : 6, the current density will be reasonably uniform. The size of the anode also influences the current distribution, and it is necessary to ensure that, in the case of anodes of roughly cubic or spherical shape, the distance to the nearest pile should be at least three times the anode diameter. For long cylindrical anodes this distance should be at least the length of the anode.

The most even current distribution is obtained by the use of remote anodes. However, this is often not desirable for wharves due to the danger of (a) ships' anchors fouling the anode leads and (b) the ship being corroded by the passage of some of the electrical current through it. (The latter can be overcome by connecting the ship to the wharf by means of a very low resistance cable.)

- (4) Sizes of Anode Leads and Bus Bars:

The anode leads and bus bars should be designed to carry the high pre-treatment currents with a voltage drop of not more than three volts. These voltage drops should not vary by more than 10 per cent. of the applied voltage.

The pile caps should be connected together, either by the existing superstructure or additional bus bars, in such a manner that the maximum voltage drop does not exceed 10 per cent. of the applied voltage.

### Conclusion

The application of cathodic protection to steel wharves is a practical and economic method of preventing corrosion of the submerged steel. The cost of the installation is only a small fraction of the value of the structure. This fact, however, should not be used as an excuse to install a much larger system than is necessary and omit a proper scientific design. A rational design for the normal type of installation is possible and ensures that protection is achieved with the minimum expenditure.

### Stresses in Crane Structures.

A new British Standard has been published in an endeavour to secure a basis for crane design which will result in economy in the use of steel. Experiments are still in progress to verify these recommendations but it is thought that the issue of an interim report will be of assistance.

The report advocates certain changes in the method of considering stresses in crane structures compared with the methods employed in existing British Standards for cranes. Tables are given of basic stresses in certain specified materials which are related to the specified yield points of those materials. These basic stresses are used in determining the maximum permissible working stresses, which are also related to the kind of work to be performed by the crane and the number of hours in service per year. Cranes are classified on this basis, to enable the user to select the correct class of crane for the work required, and the crane maker to economise in the use of material and in cost of manufacture.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 4s.

# Modern Cargo Marine Terminals

## Some Factors Governing Design\*

By FRANK W. HERRING

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ONE of the most overworked words in our vocabulary to-day is the word "modern." Even more, the words "modern design" have become the catchwords of every advertising copy writer, whether describing houses or baby carriages. That these words are used so much can most probably be ascribed to their lack of exact meaning. The artist, the engineer, the architect, the economist—each has his own idea of what constitutes "modern design."

As far as a general cargo marine terminal is concerned, "modern design" is judged strictly from a utilitarian point of view. Whether it is constructed wholly of prestressed concrete, or whether it is pleasing to the eye, or even whether it is new—none of these makes a cargo pier modern. A marine terminal can be said to be modern only when it is so constructed that it can efficiently and expeditiously accommodate the latest developments in the water and land transportation systems that it serves and also provide for full use of the latest techniques in materials handling.

### Functions of a General Cargo Marine Terminal.

The principal function of a general cargo marine terminal is to act as an interchange point for cargo moving via a combination of land and sea transportation routes. The transit shed, typically the only superstructure of consequence, takes its name from this function. Here cargo is received, sorted, consolidated, and generally processed for exchange between one form of transportation and another, not stored for an indefinite period.

There are two basic forms that a marine terminal can take, namely, the finger pier and the marginal wharf. The finger pier, as the name suggests, is a long, narrow structure jutting out into the water perpendicular to the shoreline. This type of construction is the most common in American ports and comprises the bulk of the piers in New York Harbour. In those ports where easily developed water frontage is at a premium, as it is on the island of Manhattan in New York Harbour, the finger pier is the type of pier most often used. With this type of construction, a given length of waterfront can be made to yield the maximum number of ship berths.

The second basic form of pier is the marginal wharf. The marginal wharf is constructed parallel to the shore and is employed where there is no shortage of easily developed waterfront space or where the waterway adjacent to the pier is too restricted to permit the use of the finger pier.

Whether the finger type or the marginal wharf type pier is used depends on the economic geography of the particular port. There is no intrinsic advantage in either type as far as modern design is concerned.

### Factors Governing the Design of a Modern General Cargo Marine Terminal.

At the outset let us recognise that there will always be a certain number of piers in a port that are of obsolete design. Marine structures are usually built for long life, with an amortisation period of 40 years or more, and long before a pier has suffered any fatal physical deterioration, it is likely to be behind the times. Fault can only be found when new piers are built and the design features of the old pier are merely copied.

Perhaps the best way to open a discussion of the design requirements for a modern general cargo terminal is to review the changes that have taken place in the last 50 years in ocean and land transportation and in materials handling techniques. If a pier is built to accommodate a horse and wagon when the motor truck has long since taken the horse's place, the pier certainly cannot be considered modern. Again, if a pier is built to provide space to accommodate the cargo of a ship the size of a sailing ship, that pier cannot be considered modern.

One of the most revolutionary changes during this period has been the development of the motor truck. As recently as 25 years ago, the motor truck was not an important element in our transportation system. To-day, it is as important as the railroad in many ways. In connection with the transportation of oceanborne cargo to and from piers, the motor trucks is now carrying as much as 50 per cent. of the cargo, for either local delivery or long-haul transportation. Moreover, it is still growing as a factor in the land transportation of freight having overseas origin or destination. Conversely, railroad freight appears to be declining in relative importance in the carriage of cargo to and from marine terminals.

Ranking in importance with this development of the motor truck is the development of labour saving devices for cargo handling such as fork-lift trucks, small mobile cranes, and other equipment for use on the wharf proper. The baling hook, the hand truck, and the longshoreman's back muscles, while they are still in use to-day, are no longer the principal elements of the materials handling system, as they were 50 years ago.

The ship itself has also grown during the past half century. Although overall size has not shown any striking increase, there has been a great increase in cubic capacity for a given size of a ship. This means that a ship of a given length and draft is carrying up to 100 per cent. more cargo in its holds to-day than it did 50 years ago. The speed of a ship has also increased but not radically enough to be of direct importance to the design of the general cargo terminal.

Another important change affecting the design of the cargo terminal has been the development of rapid communication methods. To-day the importer can telegraph anywhere in the world to order whatever goods he desires. The frequency of sailings, the speed of ships, the rapidity of communications, and the reliability of sailing schedules have made it unnecessary for the importing merchant to maintain large inventories. Not only does this require a different concept of merchandising, it also requires a different concept in the design of the marine terminal.

There are other changes that have taken place in the past 50 years, but these that I have enumerated are the principal elements which affect the construction and design of the modern cargo terminal. Each of the changes, in turn, has produced various offshoot developments which also have to be considered in pier design. I shall attempt to show how these developments affect and actually create the design criteria for the cargo pier.

### Development of Modern Standards.

As I have said, the over-the-road truck is now the most important single element to be considered in the design of a general cargo marine terminal.

If the terminal is of the finger-pier type, it is not only necessary to provide cargo and working space on the pier, but it is also necessary to provide an unimpeded roadway for truck egress and ingress. Even before cargo space is considered, therefore, the modern cargo terminal requires greater dimensions than the typical terminal designed a generation ago. If the construction is of the marginal wharf type, truck back-up spots must be provided on the inshore side of the shed. In this form of terminal construction, it is desirable to provide loading platforms at the height of the truck tail gates to eliminate unnecessary lifting of cargo in the truck loading operation.

The increasing use of over-the-road trucks also demands a considerable amount of careful planning of the general layout of the upland area. Sufficient space and adequate traffic control must be provided for the waiting lines of trucks coming to the pier to pick up or to deliver cargo. The amount of space that is necessary for such waiting lines is minimised if the pier itself can assure quick despatch to loading or discharging trucks.

The motor truck dimensions and the space required for manoeuvring may be controlling factors in the spacing of columns, and

\* Paper read in New York at the 1954 Annual Convention of the American Society of Civil Engineers.

### Modern Cargo Marine Terminals—continued

the vertical clearances of beams and doors are also affected by the vehicle height.

The increasing use of the truck has also cut into the proportion of cargo moved by rail. This has resulted in a reduced need for extensive rail facilities at the terminal. This is not to say that rail facilities may be ignored but merely that rail transportation is no longer the dominant means of moving cargo to and from a marine terminal for general cargo. Further, the diminishing use of rail also means that there is a diminishing proportion of direct transfer from rail or lighter to ship. Cargo that once moved in this fashion, without even temporary storage at the terminal, must now be accommodated in the transit shed, increasing the required pier space still further.

The great number of labour saving devices that have been introduced into the handling of cargo constitutes the second major factor affecting pier design. The first and most notable of these devices is the fork-lift truck. The introduction of this piece of equipment has revolutionised the entire system of handling general cargo. Instead of manhandling each item as was done in the old days, cargo can now be assembled on pallets and carried a ton or more at a time from the side of the ship to the place of stowage on the pier and vice versa. With the use of fork-lift trucks, cargo can now be stacked as high as 20-ft., whereas before, it could be piled only as high as the longshoreman could reach. This has a two-fold effect on the design of the pier, namely, the overhead clearance requirement has been increased and the load-bearing capacity of the wharf must be much greater. To provide fully for the use of the fork-lift truck, the cargo pier must also have a smooth, or at least even, deck surface, uninterrupted aisles, and adequate aprons.

The changes that have taken place in the ships that are served by general cargo terminals have not been as radical as the changes taking place in land transport and in materials handling techniques. The most notable change is the increased volume of cargo carried in a single ship. This necessitates the provision of greater amount of shed space to assure satisfactory terminal operation.

Finally, a profoundly important change has taken place in the field of communications. The trans-Atlantic cable, the world-wide radio network, and the greater speed of ships have tended to cause a marked change in merchandising practices. The custom of many merchants ordering small amounts of goods creates a situation in which a ship carries an enormous variety of items on its manifest, a far larger number for a given tonnage than characterised ocean shipping of the nineteenth century. The pier, therefore, must provide sufficient space to accommodate the sorting, separate stacking, and consolidation of these shipments. In other words, space requirements are increased even on a per-ton basis.

#### Current Standards.

Using the C-2 vessel as typical of the American ships likely to be berthed at a pier to-day and taking into consideration the developments described above, minimum standards can be established for the controlling dimensions of the modern general cargo marine terminal. The ship berth should be at least 550-ft. in length and should have a depth along side of 32 to 35-ft. at mean low water. The slip between two adjacent piers should be at least 250-ft. wide. If two or more ships are to be berthed at either of the piers, a still greater slip width, 330-ft. or more, is needed.

Making allowances for the factors enumerated above, it has been calculated that a minimum shed space of 90,000 square feet is required for each ship berth. The apron of a pier should have a minimum width of 15-ft., unless it bears rail tracks when its width will depend on the number of tracks to be installed. The overhead clearance within the shed must be at least 20-ft., the floor loading capacity must be between 500 to 600 pounds per square foot, and the doors must be of adequate height to accommodate over-the-road trucks and all of the various cargo handling devices used on the pier. Besides these strategically important dimensions, the standard items of any construction such as illumination, fire protection, and sanitation facilities must also be provided in accordance with modern thinking in those fields.

The 90,000 square foot requirement for shed area for each ship berth can be explained as follows:—

Freight rates on oceanborne cargo are computed on the basis

of "weight" tons and "measurement" tons. A long ton of cargo that stows in less than 40 cubic feet is known as "weight" cargo and freight is charged at so much per weight ton. The lighter commodities, those that occupy 40 cubic feet or more per long ton, are referred to as "measurement" cargo and freight is charged on a measurement ton basis of 40 cubic feet to the ton.

The general cargo which is shipped through the Port of New York averages about 70 cubic feet to the long ton; therefore, most of it is shipped as measurement cargo.

After careful studies, it was found that the typical dry cargo ship calling at a New York terminal loads and discharges about 12,500 measurement tons. Half of this cargo is discharged from the ship, the other half is loaded. Since the ship must be discharged first, then loaded, the transit shed must be designed to accommodate both inward and outward cargoes at the same time.

These 12,500 measurement tons occupy 500,000 cubic feet and this is the volume for which storage space must be provided within the shed. Most of this cargo can be palletised and stacked three



Fig. 1. New marginal wharf type cargo transit sheds at Port Newark, New Jersey. The rear of each shed has a freight platform abutting on a 100-ft. wide roadway and two rail tracks laid flush with the surface.

tiers high. These three tiers will reach about 15-ft. in height, less 6-in. for each of the three pallets, or a net height of about 13½-ft. The floor area requirement, therefore, would be 36,000 square feet if all the stacks were full height. But some stacks will be short, because of broken lots. To allow for the inevitable lost space, the 36,000 square feet theoretically required is raised by 25 per cent., to 45,000 square feet. Another 45,000 square feet will be required for working aisles, for truck roadways, and truck loading spots. The total gross area requirement of 90,000 square feet per ship berth is the figure that has been adopted by The Port of New York Authority as the minimum for a modern general cargo berth and which has been applied to the design of its new marine terminal facilities.

The area requirement stated above includes provision for 30 truck berths, each 40-ft. by 12-ft., for loading and unloading. That number is based on the assumption that the 12,500 measurement tons of cargo are delivered to or taken from the pier in five working days. It also assumes that half the cargo moves by truck and that the average truck load is ten measurement tons. This amounts to 1,250 measurement tons a day, moving in 125 trucks. For an eight-hour day this means that about 16 trucks must be handled every hour. Since it takes almost two hours on the average to load or unload a truck, about 30 available truck spots for each berth are needed.

Obviously, terminals cannot be standardised in design. There is ample reason for considerable variation, not only as between ports but even between different areas within the same harbour. Where the dominant movement of freight is by rail, trackage facilities will have to be given more prominence and motor vehicle roadways less. Although the 90,000 sq. ft. figure for the transit shed is valid for a terminal at which an entire ship load is to be

## Modern Cargo Marine Terminals—continued

handled, in the smaller ports where ships load and discharge only part cargoes, or at some terminals within a major port, a proportionately smaller figure can quite properly be used.

### Modern Design Illustrated.

Several examples can be cited to illustrate the varieties of design that are possible while still meeting modern criteria. Among recent developments in New York are the Hoboken-Port Authority piers and the new terminals developed at Port Newark. One of these projects uses the finger-pier plan while the other utilises a marginal wharf. Each, by a different approach, has been designed to handle the new large ships and to accommodate comfortably trucks, freight cars, and lighters. Both projects called for single-deck transit sheds with 90,000 square feet or more gross shedded area per berth and the other standards discussed in the foregoing paragraphs have been applied in design. The Port Authority's new Pier C at Hoboken, a two-berth facility, is 700-ft. long and 328-ft. wide. This is probably one of the most spacious two-berth piers in the United States. One apron of this pier is 20-ft. wide, while the other, which bears one railroad track, measures 25-ft. The shed has a centre well 500-ft. long to accommodate two depressed railroad tracks and it also has a U-shaped two-lane truck boulevard surrounding the centre well to permit one-way truck movement.

The cargo pier development at Port Newark, on the other hand, follows the quay-type construction. There, a minimum length of 550-ft. is allowed for a ship berth, the apron measures 50-ft. and bears two railroad tracks. The rear of each shed has a tail-gate-high freight platform abutting on a 100-ft. wide paved roadway and two rail tracks laid flush with the surface.

The Hoboken and Port Newark facilities are both new and modern. On the other hand, several good examples of modernisation can be cited whereby existing obsolete piers have been modified to conform to the needs of modern transport methods. In San Francisco Harbour, for instance, two existing piers, 680-ft. long and 203-ft. wide, have been joined by a pile-supported platform which occupies what was formerly the 222-ft. intervening ship. The centre portion of the platform, 150-ft. wide, was designed as a depressed well for truck manoeuvring and back-up and for rail track accommodation. The remainder of the slip width was utilised for pier and shed widening. The terminal now provides three generous berths, one on each side and a third across the end. The entire facility is leased to the Matson Navigation Company which operates general cargo and passenger ships in the trans-Pacific service, and it has been in operation since January, 1952.

Other illustrations can be cited of modernisation of older facilities so as to make provision for motor trucks, fork-lift trucks, and other important developments in cargo handling.

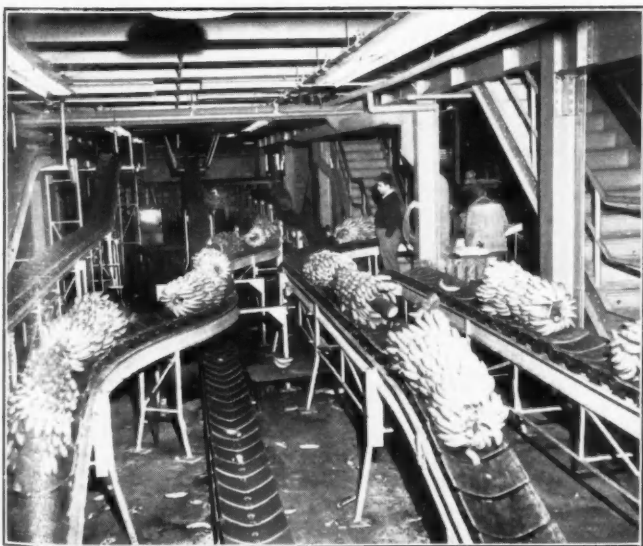


Fig. 3. Horizontal "curveyors" carry bananas to the waiting transport.



Fig. 2. At the Weehawken Interchange Terminal, New Jersey, four cranes transfer the stems of bananas from the ship's holds on to conveyor belts.

### Specialised Cargo Facilities.

There are certain specific commodities which are transported along regular routes in sufficient quantities to justify specialised facilities designed for the handling of that commodity alone. Bulk liquids, such as petroleum products, can be pumped into and out of ships' tanks, bulk ores and grain can be gravity loaded into ships' holds through chutes and unloaded by giant 20-ton cranes, while stems of bananas can be unloaded by endless belts and other special machinery. Two especially interesting facilities in New York Harbour are the "Daily News" newspaper terminal in Brooklyn, and the United Fruit Company's banana unloading terminal in Weehawken, New Jersey.

At the newspaper terminal a permanent crew of 28 men operate a system of conveyor belts, hoists, and specially-designed fork-lift trucks to handle rolls of newsprint moving to the terminal by ship, barge, and box car and from the terminal to the plant via truck. Longshoremen unload the ship and place the newsprint rolls on the conveyor system at shipside. All of the "Daily News" requirements of about 1,000 tons of newsprint each working day move through this facility.

The Weehawken Interchange Terminal, as the banana unloading terminal is called, is designed to facilitate the rapid and safe transfer of stems of bananas from steamships to refrigerated cars and trucks. Four specially-designed travelling cranes housing endless belt conveyors transfer the stems of bananas from the ship's hold to an extensive system of horizontal belts called "curveyors," which run between strings of refrigerated cars and over-the-road trucks. A crew of 330 longshoremen can transfer a shipload of 60,000 stems of bananas from a ship to rail cars or to motor trucks in an eight-hour day.

Each of these facilities is new, the newspaper terminal was completed three years ago, and the Interchange Terminal two years ago; and each is designed around a materials handling system tailored to fit the specific needs of one industry.

### Conclusion.

I have endeavoured to present in this paper a concept of modern general cargo terminal design. Whenever a terminal becomes a bottleneck to cargo movement, it cannot be considered modern. Modernity consists simply of integrating the cargo pier into the system of handling cargo from and to the oceangoing vessel.

Even though I have presented the criteria for what I should call a modern facility, I should like to repeat that terminal design, of course, cannot be standardised. My main purpose has been to emphasise the factors of modern transportation technology that should govern the design. I want also to emphasize that we must expect transport technology to continue to advance and that terminal design must be correspondingly progressive.

# Timbers for Sea Defence Work

## Practical Tests Carried Out at Shoreham

By R. P. WOODS, B.A.For. (Cantab.)  
Chief Scientific Officer, Timber Development Association.

**T**IMBER has been used for sea defences in the shape of groynes since before 1582, and even with the advent of alternative materials such as cement, steel, etc., is still generally preferred. This is largely due to its comparative cheapness and the ease with which it can be adapted to changing conditions, or repaired, or because in some cases it has a high salvage value.

### Sea Defence Groynes.

The object of these structures is the prevention of erosion caused by the action of waves, the arresting of littoral drifts, and the protection of low-lying lands from inundation. The general construction is by means of piling, braced by longitudinal waling and planking with land-ties set in at right angles to the face of the groyne. The favoured timber for piling has been pitch pine (*Pinus palustris*), with greenheart (*Ocotea rodiaei*) and elm (*Ulmus* spp) and Douglas fir (*Pseudotsuga taxifolia*) following. Other timbers used are oak (*Quercus* spp), jarrah (*Eucalyptus marginata*), larch (*Larix decidua*), beech (*Fagus sylvatica*), blue gum (*Eucalyptus globulus*), pyinkado (*Xylia dolabriformis*), turpentine (*Syncarpia laurifolia*), and European whitewood (*Picea abies*), in approximately that order of popularity. For the walings a change is noticeable, Douglas fir, pitch pine and elm are preferred, with jarrah and oak following. Greenheart and European whitewood come next, with redwood (*Pinus sylvestris*), larch, beech, rock elm, karri, and brush box (*Tristania conferta*) being used. No particular preference was shown for land ties, apart from pitch pine, Douglas fir and oak.

### Dimensions.

The most common size for piling for this category of work is 9-in. by 9-in., but sizes up to 14-in. and 18-in. by 18-in. have also been recorded. The lengths varied according to the local conditions where these groynes were placed. No pile exceeded 20-ft. in length, and the average appeared to be 12-ft. to 14-ft. Walings were generally 3-in. by 9-in. and 6-in. by 12-in., with 6-in. by 9-in. following closely; 17-ft. and up were most frequently used, but a fairly wide variation was included.

### Performance.

Pitch pine is generally conceded to be the most acceptable timber for this purpose, since it both resists abrasion and has a noticeable lack of splitting when the piles are driven. Greenheart is considered excellent in resistance to abrasion, but tends to split when subjected to heavy blows and requires protection by means



Fig. 1. Wooden Groyne, Shoreham beach, showing shingle accumulation on windward side—also abrasion of pile at planking level.

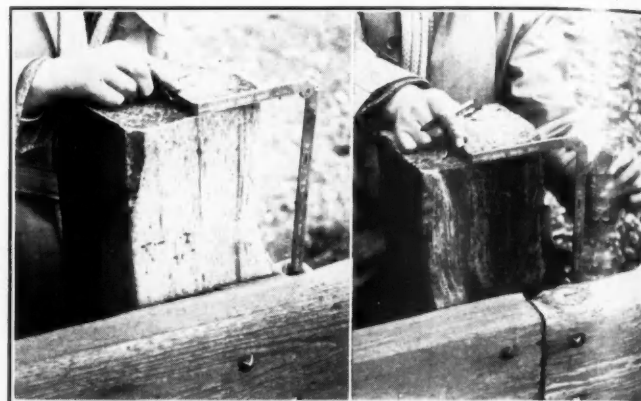
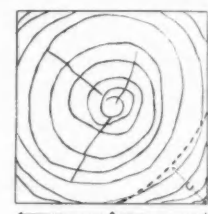


Fig. 2. Greenheart Pile (left) and Wallaba Pile (right) and Diagram (Fig. 3) illustrating method of measuring erosion.

- A. Face Parallel with Planking.
- B. Seaward Face.
- C. Depth of Penetration.



of hoops when driven, particularly if allowed to undergo a period of air seasoning. Jarrah is another timber which has been highly praised as resistant to both abrasion and marine borers. Douglas fir does not resist abrasion as do the others and is more prone to decay. The question of pressure treatment will be dealt with in the appropriate section, but where there is regular and continuous abrasive action the treating of the wood is of doubtful value, as the treated area may be worn away without the anticipated benefit of the treatment being achieved.

Considerable variations exist as to the recorded life of piles and groynes. It is a recognised fact that wood continually immersed should last almost indefinitely, provided there is no mechanical damage or attack by marine organisms. Greenheart, jarrah and pitch pine are stated to give service of up to 50 years.

In comparison, untreated Douglas fir gives only 15 years as a maximum, and in some cases less. Again this is dependent upon beach conditions, and thus it is possible to find considerable variations in expectations of service.

### Preservatives Used.

The use of preservatives for this particular aspect of marine work does not appear to be a universal practice. Creosoting both by the full cell and empty cell processes, together with the incising of refractory timbers, is specified by 18 authorities, and seven are experimenting with the water-borne preservatives. With regard to preservatives of the latter type, no official data is available as to their efficiency, due to the relatively short period of service. Where heavy scour occurs, treating the timber is of little advantage, but it has proved useful on sandy shores where there is little abrasive action and against marine borers. In any groyne there are three distinct sections—the landward end, sometimes referred to as the “pocket section”; the “main section”; and the “spur” sections, which is usually under water. Preservative treatment would be of advantage for the timbers in the “pocket” and “spur” sections, but if the beach has a high degree of shingle little advantage would

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## Timbers for Sea Defence Work—continued



Fig. 4. Reading from left to right: Greenheart, Mora, Douglas Fir (control) and Wallaba Piles.

be gained by treating the main section, due to severe mechanical breakdown. If 100 per cent. penetration could be guaranteed, it might be considered, but the general consensus of opinion is that in this section groynes fail through mechanical breakdown rather than by fungal or borer attack.

## Practical Tests.

With the co-operation of the Shoreham & Lancing Sea Defence Commissioners, facilities were given to the Timber Development Association to test other timbers which, apart from greenheart, had hitherto not been used for sea defence purposes. There were sufficient timbers to construct a complete main section of a groyne as used on this stretch of the coast.

After a year's exposure to the force of the summer and winter gales, the timbers which were incorporated were subjected to a searching examination.

The timbers were greenheart, wallaba and mora, with a Douglas fir pile as a control. Piles, walings and planking were supplied in each species in the following dimensions: 9-in. by 9-in., 6-in. by 9-in. and 6-in. by 3-in. In addition other timbers, namely opepe, brush box and mubura, were incorporated as repair material into existing groynes. Denya/okan and dahoma have been installed at Eastbourne, but have as yet had no prolonged exposure compared with the other timbers. The object of the test

is to determine the resistance of these timbers to abrasion caused by tidal movement of the shingle on this part of the coast.

In all cases wear has taken place on the corner faces exposed to the westerly drift of the shingle. As can be seen from Fig. 1, the piles hold up to their full 9-in. faces where protected by the planking, and just above this point erosion has commenced. The following measurements (see Fig. 2) have been taken for all piles: along the face parallel with planking = "A"; on the seaward face at right-angles to the planking = "B"; depth of penetration measured across the angle formed by these two faces = "C". The table below gives the results using this form of measurement of resistance to erosion.

	"A"	"B"	"C"
Opepe Pile No. 1 ...	2"	3"	2½"
" " " 2 ...	2½"	6"	2½"
Brush Box Pile No. 1 ...	2½"	5½"	1½"
" " " 2 ...	2½"	4"	2"
Douglas "fir" ...	1"	2"	1"

In each case pile No. 2 has shown greater wear. This is due to the fact that they are situated in the area of greatest shingle concentration, with consequent heavier erosion taking place. "B" measurements show a decrease to the outer edge. Abrasion has been heavy over the whole face "B", "D" and along "A", diminishing in each case to the outer edges — ¼-in. — ½-in. has been lost over these faces.

Home-grown oak piles, planks and waling have been installed

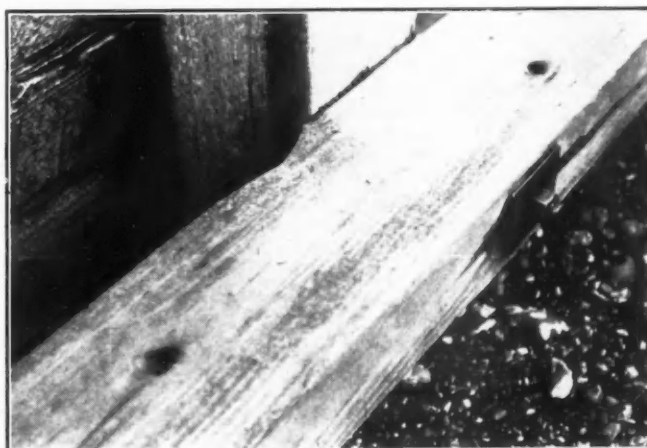
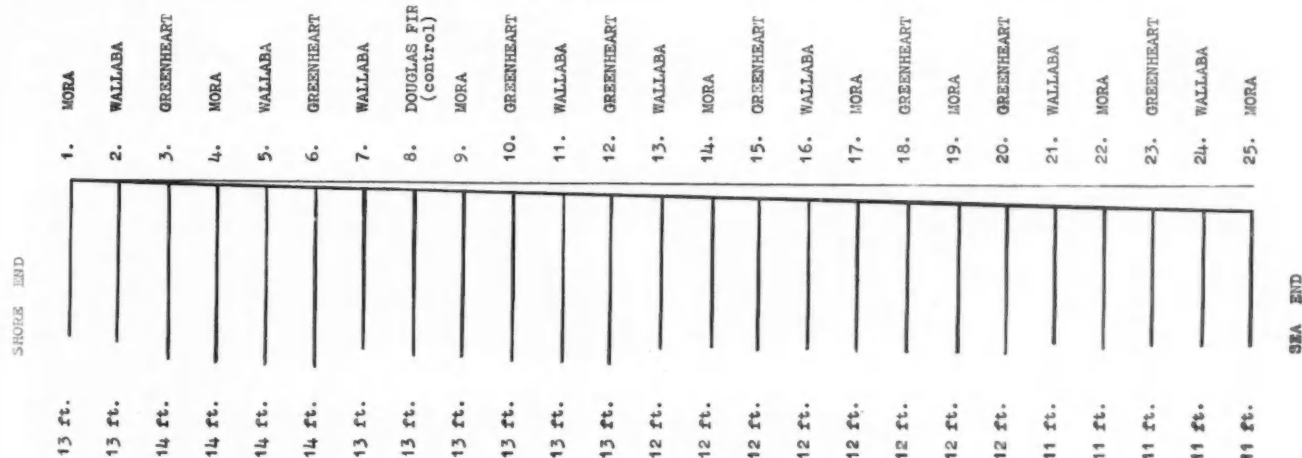


Fig. 5. Greenheart waling showing the effect of "spill-over" from the west side of the groyne.



The piles were driven at intervals of 5 ft.

Fig. 6. Driving Plan of the Groyne, showing various timbers used.

## Timbers for Sea Defence Work—continued

	SHORE END	" A "	" B "		" C "
1.	Mora	2"	8"		2"
2.	Wallaba	2"	8"	$\frac{1}{2}$ " wear on face	1 $\frac{1}{2}$ "
3.	Greenheart	2 $\frac{1}{2}$ "	9"	$\frac{1}{2}$ " wear on face	1"
4.	Mora	2"	9"	$\frac{1}{2}$ " wear on face	1 $\frac{1}{4}$ "
5.	Wallaba	3 $\frac{1}{2}$ "	9"	$\frac{1}{2}$ " wear on face	2"
6.	Greenheart	5"	7"		1 $\frac{1}{2}$ "
7.	Wallaba	9"	8"		2 $\frac{1}{4}$ "
8.	Douglas fir (Control)	5"	9"		1 $\frac{1}{4}$ —1 $\frac{1}{2}$ "
9.	Mora	3"	9"		2"
10.	Greenheart	4"	9"		1 $\frac{1}{2}$ "
11.	Wallaba	5"	7"	$\frac{1}{2}$ " wear on face	2 $\frac{1}{4}$ "
12.	Greenheart	2"	3 $\frac{1}{2}$ "		1 $\frac{1}{2}$ "
13.	Wallaba	2 $\frac{1}{2}$ "	4"		1 $\frac{1}{2}$ "
14.	Mora	2"	3"		1 $\frac{1}{2}$ "
15.	Greenheart	1 $\frac{1}{2}$ "	2"		1"
16.	Wallaba	2"	3"		1 $\frac{1}{4}$ "
17.	Mora	1 $\frac{1}{2}$ "	2"		1"
18.	Greenheart	1"	1 $\frac{1}{2}$ "		1"
19.	Mora	1"	1"		1"
20.	Greenheart	1"	1"		1"
21.	Wallaba	1"	1 $\frac{1}{2}$ "		1"
22.	Mora	1"	1"		1"
23.	Greenheart	Nil	Nil		1"
24.	Wallaba	Nil	Nil		1"
25.	Mora	Nil	Nil		1/16"

2' diag. spill-over  
18" diag. spill-over  
 $\frac{1}{2}$ " back edge "D"  
knot in edge  
2' diag. spill-over  
2' diag. spill-over  
edge  $\frac{1}{2}$ -in. thick split down 3 $\frac{1}{2}$ '  
Barnacles present  
Barnacles present  
Barnacles present

in another groyne, but since this work has only just been completed, comparative measurements are of little or no value at present.

Examining the main section of the groyne containing the British Guiana timbers, a similar pattern of erosion can be seen, i.e., steadily increasing in severity according to the position of the piles as they approach the shore end of the groyne. Fig. 6 below shows the position of the piles as they were driven. Fig. 4 shows the three main species, including the Douglas fir control pile. The erosion can be seen on the edge exposed to the full force of the shingle. Fig. 5 shows the effect of "spill-over" on to the waling. Each pile in this groyne was measured, using the same method as for the Greenheart and Wallaba (see Fig. 2), and the table above gives the results.

The phrase "diagonal spill-over" means the wear caused by the shingle being thrown over the edge of the top planking down across face "B" (in Fig. 2) on to the waling and beach on the east side of the groyne.

An examination of the figures above shows that wallaba is showing the least resistance, and it is noticeable that the long fibres tend to hold on somewhat better than the shorter fibres of the greenheart, which give a smoother wearing surface. The wallaba piles are noticeable by their shaggy appearance. Mora appears to be standing up remarkably well. The wear on piles 3-10 on face "B" is in the position of maximum possible wear,

and whilst the surface has been eroded the degree of intensity diminishes from corner "A, B" to corner "D". (See Fig. 2.) It was not possible to measure this to any degree of accuracy, due to the top 2-in. being chamfered for the fitting of the driving ring, but it was estimated at  $\frac{1}{8}$ -in. to 2-in. at point "C".

The control pile, having a knot just above the edge of the planking, does not give a true picture for comparative purposes, but assuming this were not present, it is probable that erosion would have been in the order of 2-in. or more. In order of resistance to the abrasion, the timbers can be classified as brush box, mora, greenheart, opepe and wallaba. The planking in every respect has only shown slight rounding of the arris edge, the faces standing showing little wear.

The conditions existing on this stretch of the South Coast are, perhaps, the most exacting of any in Britain, when abrasion is taken into account. It is interesting to note, however, that all these timbers are standing up surprisingly well when used in the form of planking, and it is only the exposed portions of the piles above the planking which are experiencing the heavy abrasion.

Thus it could be taken that all these timbers would be suitable for piling in places where heavy abrasion does not occur, such as on sand beaches, etc.

Further measurements will be taken at yearly intervals, and additional timbers will probably be tested.

## Expansion of U.K. Steel Industry

### New Ships and Ore Unloading Equipment

The Iron and Steel Board's plan for the development of the iron and steel industry (1953 to 1958) was published last month (Stationery Office, price 1s. 9d.). It estimates that home demand at the end of 1958 will be in the region of 19.5 million tons, and that production will be at about 22.5 million tons, leaving some three million tons for export. A number of schemes for increasing production are listed in the plan, their total cost being estimated at just over £250 million.

On the subject of steel plate the report states that the main consumer is the shipbuilding and marine engineering industry, which accounts for more than a quarter of the total output. The proportion of plate to other steel used in shipbuilding has grown with the development of new techniques of construction, and this, together with the possibility of fluctuations in shipbuilding, makes future estimates more than usually difficult to formulate. Consumption of steel plate by the shipbuilding and marine engineering industry in 1951 was 549,000 tons; in the period October, 1953, to September, 1954, the total had risen to 653,000 tons.

The import of iron ore is expected to increase to 17 million tons

by the end of 1958, and the additional tonnage of ore to be shipped to the United Kingdom will require the provision of further ships, and also improvements in ore unloading equipment in British ports. The industry has made arrangements for the building of 19 specially designed ore carriers. Of these, twelve are of 8,500 tons capacity, being designed especially for the shallower ports, such as Port Talbot, Barrow and Workington. The remaining seven ships are of 13,500 tons capacity. The desirability of building more ships of these sizes and also ships of 20,000-22,000 tons capacity is under consideration. Although the last-mentioned ships could only use a limited number of ports for dispatching and receiving ore, the developments on the Tyne, the Clyde and the Tees should enable them to be used for part of the United Kingdom ore traffic with resulting transport economies.

Since the war, ore unloading facilities in United Kingdom ports have been progressively improved and by 1958 further developments will have taken place. As a consequence modern unloading plant will be available on the Tees, Tyne, Clyde and Mersey, in the Bristol Channel ports, and at Irlam, Dagenham, West Hartlepool, Barrow and Workington. Between them these plants will handle the main bulk of ore imports. The major increase expected in the intake of imported ore, however, will necessitate continuing improvements in the shipping, ore-handling and ore-stocking arrangements and these are being kept under review.

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# The Humber Ports

## (6) Engineering Works at Grimsby and Immingham

(Specially Contributed)

(Continued from page 302)

Engineering developments at the Hull Docks of the British Transport Commission have been described in a previous article. At the Humber Ports on the south side of the river war damage, although extensive, was not of such a devastating character and developments there have been dictated more by the need for overtaking arrears of maintenance and for effecting improvements to meet the requirements of post-war traffic, rather than by the replacement of facilities destroyed by enemy action. This article describes briefly the progress which has been made during the time the British Transport Commission has been in control of the docks at Grimsby and Immingham.

### GRIMSBY

#### Roadways.

The need for improvement of the extensive system of roadways serving the quayside sheds at the Fish docks and the many premises housing the varied activities of the fishing industry, was immediately apparent. These roadways were mostly of sett-paved construction and unsuitable for modern traffic, and increasing use of road transport soon called for a comprehensive programme of road reconstruction.

The first stage was put in hand in 1950 with the resurfacing in concrete of a street used not only for local traffic but also for the temporary stacking of fish boxes and offal kits. Experience had shown that neither portland cement concrete nor any form of tar composition would stand up to the continual seepage of fish juices resulting from such conditions and it was decided to adopt a concrete slab construction with a wearing surface of granolithic aggregate using high alumina cement throughout. This form of construction was adopted in preference to

any kind of two-layer design in view of the necessity of carrying out the work in the shortest possible time and with a minimum of interference with fish traffic operations.

A new roadway has been constructed at the south east corner of No. 3 Fish Dock as a first stage of development of a further portion of the dock estate. As the ground in this area is not fully consolidated the specification of the roadworks provided for 3-in. tarmac on a 12-in. thickness of rolled hardcore; if any differential settlement occurs under traffic it can be made good more readily than if the more permanent concrete slab construction had been adopted.

#### Sheds and Fish Markets.

The Principal shed accommodation in the Grimsby Commercial Docks is divided into two groups, one on the west and the other on the east side of the Royal Dock. Arrears of maintenance during the war left the West Side Export Shed in particular in poor condition. On the east side of the dock the Import Transit Shed accommodation was congested, the floors in particular being uneven and much intersected by rail tracks which prevented the use of mechanical handling appliances and trucks. With a view to providing better facilities for the rapid handling of imported dairy produce and frozen fish under more hygienic conditions authority was given in 1953 for the removal of redundant track and turntables, and the replacement in concrete of the old granite sett-paved floor in one section of the shed, for the construction of covered loading shed accommodation 345-ft. by 27-ft. behind the main shed, and for incidental permanent way alterations and drainage, the new covered shed comprises steel framework with protected metal roof sheeting, distributed roof

lights and a granolithic surfaced concrete floor.

On the Fish Docks greatly improved and enlarged facilities had been provided by the construction of No. 3 Fish Dock, opened in 1934, and a steady programme of modernisation of Fish Markets had been pursued under the London and North Eastern Railway. The markets, constructed about 1900 and comprising steel framed sheds with timber floors, carried on a timber-piled substructure were, however, in poor condition, and authority was obtained in 1953 for reconditioning these markets.

#### Lock Gates.

The whole of the lock gates at Grimsby are of timber construction, there being two pairs of penning gates and one pair of storm gates at each of the two entrances to the Royal Dock and also at the two entrances to the Fish Docks. With a pair of flood gates at Union Dock and a pair at each of the two Dry Docks, there are in all fifteen pairs of gates to be maintained. Normally a programme of consecutive overhauls of individual leaves is arranged, a temporary reversible leaf being available for each of the principal gates which is exchanged for one of the permanent leaves when required to be withdrawn for reconditioning. Naturally the war period caused some interruption in work of this class, and a complete overhaul of the 70-ft. Entrance Inner Gates, Royal Dock, had become overdue. In view of the difficulties experienced in obtaining large greenheart timbers consideration was given to the desirability of replacing the gates by new steel ones, but it was decided after inspecting one leaf in the dry that although renewal of the heel post and sill timber was necessary it would be more economical to

Fish Docks, West Pier and (right) Fish Dock Approaches, Storm Damage, January, 1953.



### The Humber Ports—continued

proceed with reconditioning of the existing gates. This work was therefore authorised and was carried out departmentally.

#### Timber Piers and Jetties.

The West Pier of the Royal Dock Basin, originally built in 1851, was extensively reconstructed in 1896 and further strengthening works were carried out in 1933. By the end of 1951 the condition of the timberwork had deteriorated so far that it was felt desirable to prepare a scheme for complete reconstruction. Before, however, this could be finalised the great storm of 31st January,

cast deck beams of the gangway, which has an overall width of only 12-ft. as compared with the 24-ft. width of the old timber structure. At a lower level, just below high water level, a longitudinal beam provides a tie between the successive bents, and also acts as a capping beam for a continuous line of reinforced concrete 18-in. x 13-in. sheet piles 42-ft. long driven on the centre line of the jetty. These sheet piles form a retaining wall against accumulated deposits of silt and also provide a wave break for the outer side of the tidal basin. At the extreme end of the pier a strong "roundhead" is provided,

works as just described have been necessitated by the combined effects of age, marine borers and stress of weather the chief reason for deterioration at the Fish Dock entrances is constantly recurring damage by crawlers running into or falling heavily against the pier structures.

The old structures were wholly of timber, and although theoretically a rigid structure this design was reasonably flexible in practice, sufficient at least for normal berthing, but was incapable of standing up indefinitely to the heavy collision impacts already mentioned. Any form of sheet piled and solid filled structure would have been very expensive, while an open-pile structure in reinforced concrete, sufficiently resilient to absorb accidental heavy impacts without setting up excessive stresses, was found to be impracticable. After careful consideration it was therefore decided that the new structures should again be of timber, but of a type designed to withstand without material damage the most severe blows which experience had shown were likely to be given to it. The essence of the design was the introduction of such a degree of flexibility that its deflection under impact would ensure the absorption of kinetic energy to the necessary extent, combined with a tying together of the whole structure by means of heavy and continuous walings so that the loads from impact at any point were spread over a long length of the pier.

The working out in detail of such a design was undertaken first in the replacement of the Middle Outer Pier; it gave rise to a number of interesting problems and resulted ultimately in the evolution of a novel kind of structure (Fig. 2). The dolphin is built up from twelve 16-in. x 16-in. greenheart piles 60-ft. long driven at a rake of 1 in 16 on a circle 15-ft. in diameter at the top. The heads of the piles are rigidly connected together by two circular mild steel bands placed around their outer faces, a series of solid packings and wedges making up the spaces between adjacent piles. Internal timber and concrete diaphragms at deck and lower levels complete the basic structure, the effect being to give such a degree of head fixity that under maximum impact conditions the lateral deflections of the pile group is sufficient to absorb 600 inch tons of energy for a top movement of about 18-in. Outside the dolphin head a system of walings and fenders, circular in plan, takes the immediate wear and tear of contact with vessels.

The main portion of the jetty takes the form of a series of twin-pile bents, mostly at 12-ft. centres but more closely spaced at the two ends which are structurally independent of the lockpit masonry and the dolphin respectively. Each bent is given the necessary degree of head fixity by means of a composite braced frame composed of reinforced concrete horizontal members and a greenheart diagonal strut. The concrete booms are secured to the 16-in. x 16-in. greenheart piles by means of friction clamps and special design, and the whole is so proportioned and designed as to develop maximum safe working stresses in all portions simultaneously at a head deflection of 18-in. Extensions of

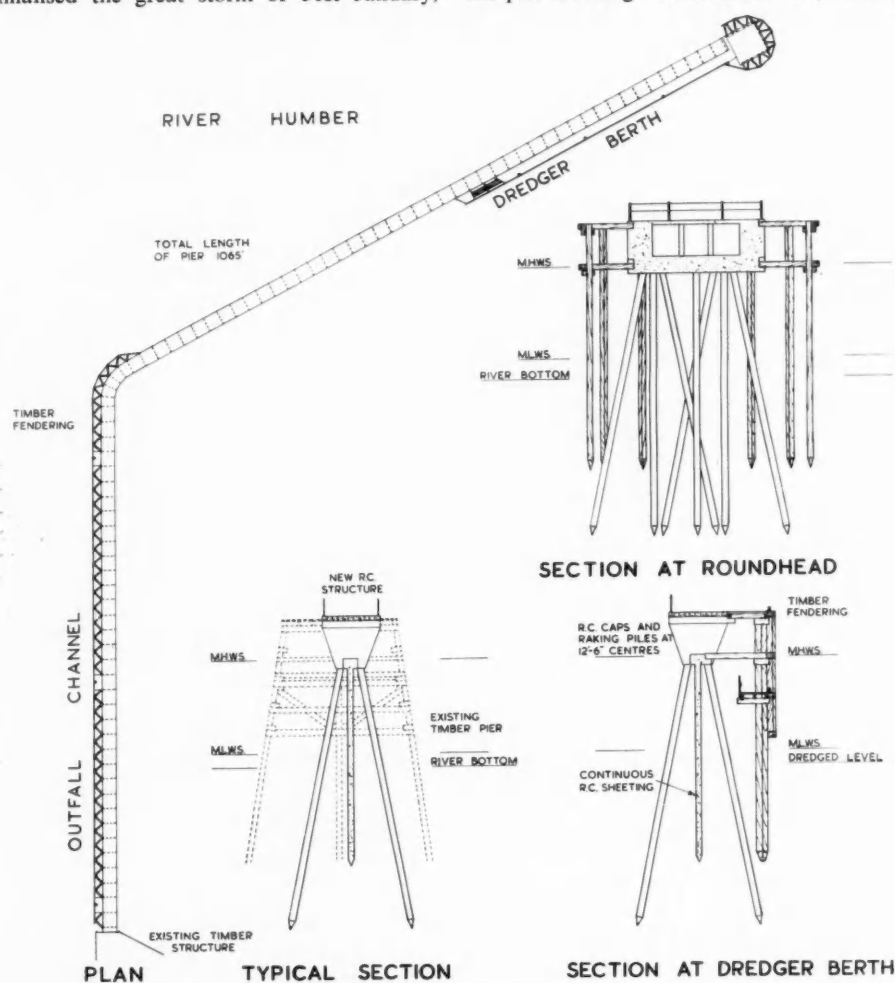


Fig. 1. Reconstruction of West Pier, Royal Dock, Grimsby.

1953, severely damaged much of the 1,100-ft. long structure, breaching it completely in two places, and immediate authority was given for the reconstruction. The work, details of which are shown in Fig. 1, comprises a reinforced concrete gangway carried on piled bents at 12-ft. 6-in. centres over a total length of approximately 1,100-ft., the first 450-ft. from the shore lying alongside the Old Outfall Channel, and the remainder running off seaward at an angle away from the channel. Each bent is formed of a pair of 16-in. x 16-in. piles 60-ft. long driven to opposing rakes of 1 in 5 and united at the top by a splayed in situ cap carrying the pre-

structurally independent of the main jetty, comprising a massive concrete slab 28-ft. square in plan and 11-ft. deep supported on raking concrete piles. Outside the concrete vertical timber fender piles are driven on a circle of 45-ft. diameter, these again being strutted off the central slab and served with walings at two levels. The deck of the "roundhead" carries navigation lights and a fogbell. Towards the end of the pier a dredger berth is provided on the inside face; here again suitable timber fenders are installed together with landings, access stairway and mooring bollards.

Whereas at the Royal Dock entrance the

### The Humber Ports—continued

the concrete booms carry raking fender posts to which are attached four 16-in. x 16-in. greenheart continuous walings, tying the whole structure together so that most of the bends are caused to deflect to a greater or lesser amount on the application of a heavy load at any point. Suitable bridge-fenders loosely linked to the main units are provided in order to cover the gaps between the masonry and the jetty, and the jetty and the outer dolphin. The uppermost concrete booms support longitudinal timber beams carrying the deck planking and a light crane gantry for use in effecting maintenance repairs. Construction of this pier, which is estimated to cost £19,000, was commenced by direct labour in May, 1954, and is expected to be complete by the Summer of 1955.

On completion of this work it is intended, subject to any modifications which experience may show to be desirable, to adopt a similar form of construction in the replacement of the longer West Pier.

#### Slipways.

Inside the Fish Docks the increasing size of trawlers has caused some difficulties at the slipways. In 1950 and again in 1951 the timber slipway jetties were seriously damaged by collision from large vessels, and in carrying out repairs the opportunity was taken of extending and strengthening the jetties so as to provide better facilities for handling these larger trawlers. Problems of accommodating trawlers approaching 200-ft. in length on slipways built in 1934 at a time when the maximum length of trawler in service was less than 160-ft. have also had to be faced.

#### Grimsby District Light Railway.

This railway, connecting Immingham Dock with the most westerly portion of the docks railway system at Grimsby, was originally constructed as a single line 4½ miles long to provide direct access between the two ports. Considerable industrial developments on the Grimsby Corporation's Pyewipe Estate, to the west of the town, and between the Light Railway and the River Humber made necessary the doubling of this line throughout and was completed in 1951. At the same time additional facilities were provided by the Commission, in co-operation with the Grimsby Corporation, for giving rail connections to private sidings for various firms developing sites.

#### IMMINGHAM

Industrial development of Immingham was continued by the establishment of an oil tank farm by the Regent Oil Company to the east of the Lock Entrance. Berthing facilities for the firm's tankers were provided at the East entrance jetty, and to facilitate operations an 85-ft. extension of the jetty was provided by means of a timber piled dolphin and access gangway, together with a downstream head mooring.

Development of Immingham for oil imports is being further advanced by the construction of a depot for the Esso Petroleum

Co. Ltd., on a site adjacent to that occupied by the Regent Oil Co.

#### Transit Sheds and Quay Improvements.

Transit shed accommodation at Immingham Dock comprises three enclosed sheds, Nos. 1, 2 and 3 at the north-east corner of the dock, all of steel framed construction with low-pitched boarded and felted roofs and 140-ft. wide, 400-ft., 290-ft. and 220-ft. long respectively, together with an open sided steel-framed shed at the Mineral Quay on the west side of the dock, 550-ft. long by 90-ft. wide. Nos. 1, 2 and 3 sheds were all

with a load of 3-tons on the hook, the wheel gauge being 15-ft., the minimum jib radius being 20-ft. and the maximum radius 65-ft. and capable of travelling at 50-ft. per minute. In order that the cranes may deal with bulk materials Priestman grabs and the necessary adjustable discharge gear are provided.

The slewing speed with full load at the maximum radius is 500-ft. per minute and the full load luffing speed is 150-ft. per minute. The luffing motion is of the rack operated level luffing type with balanced jib. The hoisting motion is driven by a 150 horse power slipring type induction motor through

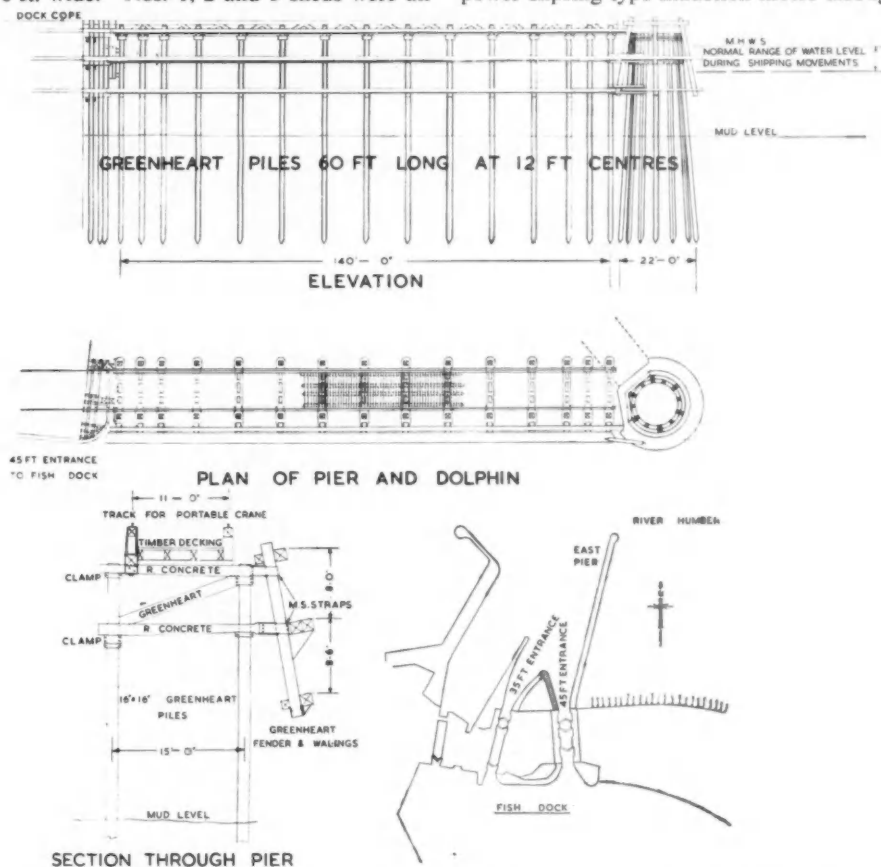


Fig. 2. Composite reconstruction in timber and reinforced concrete of Middle Outer Pier, Grimsby Fish Docks.

between 30 and 40 years old and in need of major overhaul and the Mineral Quay Shed, which was erected on this site about 1942 at a time when only light gauge ungalvanised corrugated steel sheeting was obtainable, was in need of complete renewal of the roof covering. A comprehensive programme of major repairs to all the transit sheds was therefore essential, and opportunity was taken to co-ordinate such a programme with much needed improvement of the shed floors and of the adjacent quays.

In order to commence the conversion of the Mineral quay from hydraulic to electrical operation and to speed up the discharge of bulk cargoes 4-10 ton fully portal electric cranes are being installed designed for a lifting speed of 150-ft. per minute with a load of 10 tons on the hook and 300-ft. per minute

enclosed reduction gear. The slewing (18 horse power) and luffing (15 horse power) motions are driven by slipring induction motors through worm and spur gearing.

Each crane is travelled along the track by means of two 12 horse power slipring motors through spur and worm gearing, each unit being mounted one on each sill and arranged to positively drive half the number of travelling wheels.

The front crane rail was carried directly by the dock wall; the back rail on a reinforced concrete beam which required piled supports. Some care was needed in fixing the location of the piles in a direction at right angles to the quay as they had to be driven very near to, but could not be given a bearing on, the lowest step of the dock wall.

### The Humber Ports—continued

#### Lock Gates.

The lock entrance at Immingham is 90-ft. wide with a depth of 48-ft. 6-in. on the outer and middle sills at M.H.W.S. and 36-ft. 6-in. on the inner sill, and is provided with three pairs of steel mitre gates of riveted construction, each leaf weighing about 240 tons. These gates were originally provided on the construction of the dock in 1912 and were all removed for overhaul in turn between 1928 and 1930. While the inner and middle gates were in reasonable condition, the outers were giving considerable trouble, and in 1953 it was decided to arrange for their replacement allowing for the abandonment of the original rollers and roller paths, the provision of new anchorages and for a new pair of welded steel gates to be constructed.



Improvement works at Mineral Quay, Immingham, October, 1954.

#### Permanent Way.

In addition to the provision of new sidings and connections to serve the various industrial premises established at Immingham which have been mentioned above, a considerable area of timber storage ground was made suitable in 1951 for mechanical handling of pit props by the provision of additional sidings for crane working. A large mileage of sidings on the Dock Estate generally is now due for major overhaul or renewal, much of the track having been laid down 40 years ago and in some instances then only in serviceable material, and an effective start on this work has been made during the past year.

#### Power Station Conversion, Grimsby and Immingham Area.

When opened in 1912 Immingham Dock was served completely by hydraulic appliances; the hydraulic service being

obtained from a steam driven hydraulic pumping station. In order to provide facilities to deal with the increasing traffic the Commission have decided to instal 4—10-ton Electric Cranes and 3—1,000 tons per hour capacity electrically driven coaling plants. This involves the provision of substations together with the necessary electric supply cables. At the same time, in view of the age of the equipment at the existing electric generating station situated at Immingham and supplying electricity over the Grimsby/Immingham dock area it has been decided to shut down the station in stages and take a supply of electricity at Grimsby and Immingham from the Yorkshire Electricity Board.

The Grimsby supply will be afforded at 6,600 volts 3 phase 50 cycles; reactors being

hydraulic supply when the steam boilers are shut down consequent upon the closing down of the electricity generating plant. 3—600 gallons per minute high speed multi-cell turbine type pumps delivering hydraulic water at a pressure of 800 lbs. per sq. inch are being provided. Each pump is driven through a flexible coupling by a 500 horse power 6,600 volts 3 phase 50 cycle induction motor running at approximately 1,475 revolutions per minute.

The pumps will be controlled by the Pumping Station hydraulic accumulators by means of tappet switch which initiates the starting and stopping of the motors driving the pumps by means of automatic contactor controllers provided with air break high voltage stator circuit breakers.

#### Coaling Plant.

The existing coaling plant within the dock consists of five hydraulically operated coal hoists each capable of shipping coal at the rate of 600 tons per hour. To deal with increasing business three modern coal conveyors will be installed each capable of shipping coal at a maximum rate of 1,100 tons per hour. The appliances will also be capable of dealing with wagons of rated capacities of from 10 to 24½ tons, the latter being the load carried by the modern standard B.R. coal wagon.

The existing siding layout serves the coal shipping hoists end-on, loaded wagons being delivered at the hoist at ground level and empty wagons being released from the hoist at a height of some 18-ft. so that the movement of all wagons is by gravity. The new layout has been designed to incorporate the major part of the existing earthworks and sidings, loaded wagons being raised from the level of the loaded sidings by means of a mule and, after having been tipped, moving to the empty lines by gravity, the object being to maintain the existing use of gravity for wagon movement to and from the coaling appliance.

A rotary side tippler is to be designed to accommodate, clamp, and tip without damage, any type of British Railways open wagon up to a gross weight of 40 tons, a height of 10-ft. 6-in. and length over buffers of 30-ft. at a rate of 60 wagons per hour. The tippler will be of the rack operated type consisting of two sector frames connected by cross beams to which will be attached the tipping table, side bearer and top clamping arrangements, the whole being mounted on trunnion rotating in pivot bearings. The tipping table is pivoted from the main frame in such a manner that the wagon is tilted as rotation commences towards the side bearer which is padded with resilient material. The wagon is clamped automatically by means of a longitudinal pivoted and counterweighted beam which is also padded with resilient material. The rotating portion of the tippler is partially balanced by means of balance weights. The tippler is rotated by means of an electric motor of approximately 100 h.p. through enclosed worm and/or spur gearing to pinions engaged with racks attached to the outside edges of the sector frames. (To be continued)

# Commodity Infestation in Ports

## II. Duties and Relaxations

By W. McAULEY GRACIE (Director and Chief Adviser of Disinfestation Limited)

(Continued from page 317)

Speaking in the House of Lords some 80 years ago, an eminent Church dignitary said, apropos of quite a different subject: "I must take my choice whether England should be free or sober. I declare, strange as such a declaration may sound coming from one of my profession, that I should say it would be better that England should be free than that England should be compulsorily sober."

It is not the present purpose to discuss whether the particular form of freedom there envisaged was in the best public interest. For some, freedom from proper restraint is, or may degenerate into, inexcusable licence to the injury of others and as such is against the public interest.

War-time is the breeding time for statutory regulations which should be allowed to die if and when the solid justification for their use has disappeared. In the post-war period strong pressure for the revocation of war-time measures leads to the consigning of large blocks of temporary legislation to the pulping machine. It may well be that political expedience has resulted in the jettisoning of some provisions for the retention of which there might have been a case in the public interest, but on general grounds it is well to get rid of top hamper and let the fresh air in.

Some may say that there is still ground for complaint by reasonably law-abiding citizens that in the conduct of their affairs they are required to submit, even at this late date, to overmuch statutory regulation and inspection, which they rightly or wrongly consider to confer no public advantage but to be primarily an adhesive for limpets. There might be an occasional word of sympathy for the official to whom that particular and other unpleasant epithets are applied. He, like most people, must work to live, but as a good servant must not answer back to his masters and betters (*sic*). That provocative statement serves to introduce the assurance that this article treats of statutory provisions which do not deservedly fall within such maledictions.

In the previous article it was demonstrated that "there is serious economic significance of menacing proportions attaching to commodity infestation as at present existing in the world." In such circumstances, "freedom" anywhere for any party to "inject" infestation into the channels of trade is a grave form of licence, impossible to justify.

Having regard to the nature, age and extent of the infestation problem, it is somewhat surprising that it needed a war to bring about the enactment of statutory regulations for the more effective control of infestation,

as it also is surprising that legislation giving permanence to the basis of war-time regulations was passed in the post-war period, and at a time when many regulations of war-time creation were being revoked. The present state of infestation in this country would have been much more satisfactory had the Prevention of Damage by Pests Act been enacted in the years between the two wars instead of so late as 1949, valuable as it is today.

Industry and the community generally have accepted the provisions of the Act as reasonable. Indeed, industry itself pressed before the outbreak of the last war for Government action to abate this evil, and definitely inspired the later Government action in setting up a research and advisory organisation.

As evidence of this industrial interest there follows the declaration of 1940 by the Standing Conference of Contributing Interests formed under the aegis of the Department of Scientific and Industrial Research. This Conference was composed of numerous national bodies representative of many sections of industry. Here is the declaration containing the code of good practice advocated by these important trading interests:

"It being highly desirable in time of peace, and essential in time of war, that foodstuffs and other necessities of life should be saved from contamination, damage, and destruction.

It having been ascertained by scientific survey (conducted largely at the expense of industry and at the request of this Standing Conference) that pest infestation is widespread, ranging over many classes of commodities, and also over the structures and equipment whose use is essential to the storage, processing, trading, and transport of those commodities.

It also having been demonstrated that infestation by the large group of grain and fruit pests in particular is contagious and not spontaneous, and is neither inevitable nor incurable.

It having as a consequence been arranged by the Department of Scientific and Industrial Research at the request of this Standing Conference that a service providing for advice on prevention and cure, and for supervision of remedial treatment shall be available to industry, which service is now in being.

It is therefore declared by this Standing Conference that good commercial practice requires that:—

(a) Anyone receiving commodities into his ownership and care should satisfy

himself, in his own interests, of their quality and condition.

(b) Nevertheless if,

(i) the person intending to deliver the commodity, or his agent, knows it to be infested, or if

(ii) a warehouseman, or provider of transport, knows that the accommodation or equipment into which it is proposed to receive the commodity is infested, or if

(iii) there is a development of infestation of a commodity whilst it is in the care of warehouseman or transport agent:

a suitable timely notification should be made, in confidence, to the owner, the receiver, or the provider of the services involved, as the case may be, by the person, warehouseman, or transport agent concerned.

(c) Only by such means can the opportunity be provided for preventing the spread of infestation.

(d) Any arrangement within a trade recognising, as between buyer and seller, a permitted degree of infestation should not be taken as dispensing with the necessity for notification to any person, not party to the arrangement, whose accommodation or equipment may be utilized in the course of the trade in commodities whose infestation is known both to buyer and seller."

This declaration struck a shrewd blow at the policy or practice of withholding from the transferee knowledge possessed by the transferor of infestation present in goods moving along the trading chain.

As the Ministry of Food, under the ensuing war conditions, extended its responsibility for acquiring and possessing primary foods and for feeding the nation, it became directly concerned in the problem of infestation which had previously troubled industry so much. This concern reflected itself in certain statutory regulations—and particularly the Infestation Order, 1943 (S.R. & O. 1943 No. 680). The Ministry of Food had become the chief party in arrangements for owning, holding, processing, and distributing food down to various stages in the supply pipeline, and on that account as well as because its Minister was constitutionally responsible for the promotion of measures to safeguard all food, it went much further than could the Standing Conference on the point of disclosure of infestation. The original recommendation of industry, in its Declaration and Code of good practice, now under the Ministry of Food assumed a different guise and appeared clothed in all the

## Commodity Infestation in Ports—continued

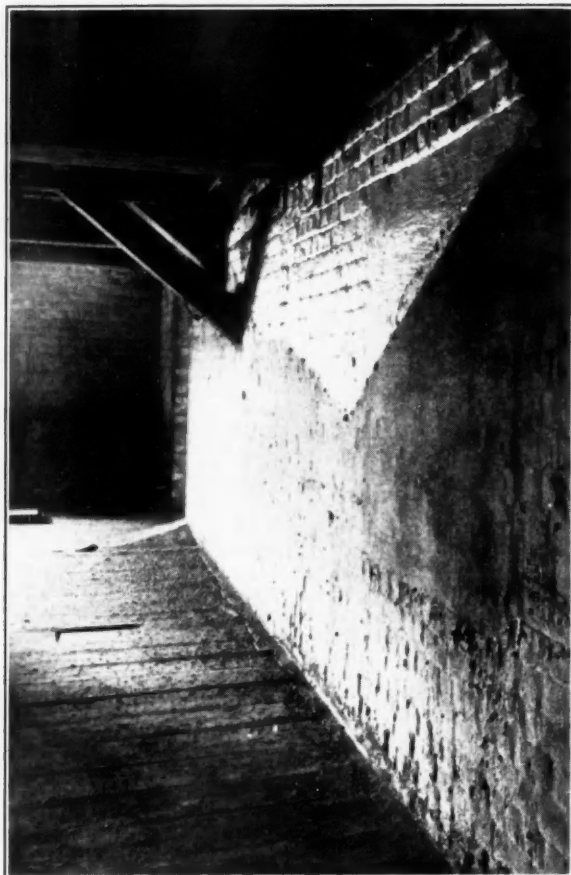
authority of a compulsory requirement to notify the Minister of the occurrence of infestation.

As that particular requirement of notification is a main feature of the later Prevention of Damage by Pests Act 1949 which, in Great Britain superseded the Infestation Order, 1943, it is appropriate to examine, with some particularity, the basis for this requirement and the nature of the duty as it affects different classes of traders.

The conditions which are subject to notification as provided in Section 28 (1) of the Act of 1949 are contained in the following definition:—

INFESTATION means the presence of rats, mice, insects or mites in numbers or under conditions which involve an immediate or potential risk of substantial loss of or damage to food and "infested" shall be construed accordingly.

The responsibility for giving notification of such infestation is set out in Section 13 (1 and 3). Sub-section 3 of Section 13 is in the nature of a proviso to what is contained in Sub-section 1, and 13 (3 (a)) empowers the Minister, by regulation, to relax or exclude the requirements for notification in such cases and subject to such conditions (if any) as may be prescribed by or under the regulations. Every person not covered by



Extensive evidence of silk deposited on wall by the larvae of moths which prey greatly on grain imports.

the relaxing or excluding provision and "whose business consists of or includes the manufacture, storage, transport or sale of food," is required to give immediate notice in writing to the Minister (of Agriculture) if he is aware that any infestation is present:

- (a) In any premises or vehicle or any equipment belonging to any premises or vehicle, used or likely to be used in the course of that business for the manufacture, storage, transport, or sale of food.
- (b) In any food manufactured, stored, transported, or sold in the course of that business, or in any other goods for the time being in his possession, which are in contact or likely to come into contact with food so manufactured, stored, transported or sold.

Certain statutory instruments made pursuant to the 1949 Act have provided dispensations from the requirements under Section 13 (1) of the Act of 1949 for particular trades and under particular conditions.

The first of these statutory instruments is an Order in Council under the title of "Prevention of Damage by Pests (Application to Shipping) Order, 1951, No. 967." This Order came into operation on the 1st October, 1951, but did not extend to Northern Ireland. It should be noted that Section 23 of the 1949 Act specified that the provisions of the Act should apply—subject to such exceptions and modifications as might be prescribed by Order in Council—in relation to vessels as they apply in relation to land. When shipping is concerned, that Order in Council should be read in conjunction with the Prevention of Damage by Pests Act, 1949.

Article 6 (1) of the Order in Council limits the duty of giving notice of occurrence of infestation to the person having the custody or control of any vessel *which is not a sea-going ship and then only in the case of infestation by insects or mites present in such vessel when used or likely to be used for the transport or storage of food, or on or in any equipment belonging to such vessel, or in any food or other goods stored or carried in such vessel.*

There is, however, a proviso enabling the Minister, on application being made, to relax or exclude this requirement as to notice, subject to conditions necessary to secure that all reasonable steps will be taken to destroy infestation in such vessel or equipment before it is used for the carriage or storage of food or other goods likely to come into contact with food.

By article 8, the provisions of sub-section 1 of section 13



Example of poor stowage, happily not a frequent occurrence in warehouses.

of the Act as to giving notice of occurrence of infestation are extended to sea-going ships *when used or likely to be used for the transport of food*, so as to require the master of such vessel to give notice of any infestation by insects or mites present in his vessel, but the Minister is empowered to grant exemption from the obligation to give notice subject to such conditions as he may think advisable.

It will be observed here that the procedure for grant of exemption from the obligation to give notice of occurrence of infestation is somewhat different from that applicable under the provisions of article 6 in the case of "other than sea-going vessels." Under article 6 an application for relaxation or exclusion of this requirement is an essential preliminary to its being granted. In the case of sea-going ships, however, the Minister's power to grant exemption, subject to conditions, is not made dependent upon individual application. The conditions on which exemption from the obligation in respect of sea-going ships is available are contained in the memorandum of arrangements, and will be referred to later in this present article.

This memorandum agreed between the Ministry of Agriculture and Fisheries and the Department of Agriculture for Scotland (in consultation with the Ministry of Transport) and the Chamber of Shipping of the United Kingdom and the Liverpool Ship-owners Association, opens with an introduction giving the background, and explaining that it does not apply to vessels transferred from normal employment for use temporarily in port storage. The memorandum contains much useful information on detailed working, but reference to it in the present connection will be limited to its relation to the regulations.

### Commodity Infestation in Ports—continued

The order covers types of craft (i.e. other than sea-going vessels) not embraced by the memorandum, and in respect of such ships confers powers wider than the provisions of the memorandum (paragraph 24).

At this point, opportunity might well be taken to explain the purpose of these relaxations from the duty of giving to the Minister notification of infestation of cargo in ships. As will be seen later, there is similar provision for relaxation of the requirement in connection with land and inland waterway transport.

The sole purpose of this notification is to enable the Inspectors of the Ministry to determine what measures, if any, are necessary for disinfestation prior to the removal of infested goods. The requirement is to be found in article 5 of the Infestation

for any other person any food or other goods which are infested with insects or mites, but of which he is not undertaking the storage."

It will be readily appreciated that if all notifiable goods were to be held up in transit for three days there would be great congestion in our ports and loss of valuable transport time, adding still further to the congestion, and acute shortage of merchandise in actual distribution would create much inconvenience. It is for this reason that there is a special dispensation from the duty of notification of commodity infestation in transport facilities and spaces, but this dispensation does not apply to commodities held in storage.

Article No. 7 of Statutory Instrument No. 416 extends this dispensation from notifica-

the purposes of the processes specified if, after discharge from the ship in which they were imported, have been moved direct to such premises from the port of entry, without any storage or warehousing, save such as may be incidental to such movement.

This particular exemption is based on the fact that the particular milling processes are such as to destroy infestation in these commodities. It is to be noted, however, that infested commodities lying in the premises, after processing, for storage or dispatch, are subject to notification and stipulated arrest period.

It is of some importance for it to be realised that the duty of giving notice of infestation of food stuffs and other goods, including food containers, is laid upon the party in whose custody or possession (not necessarily ownership) the infested commodity may be at the time of discovery. Thus, e.g. the requirement falls upon the warehouse keeper with whom the goods are stored and not directly upon the owner at whose orders the goods are stored.

There is a special proviso to article 5 in Statutory Instrument No. 416 to cover the case of infested food or other goods held temporarily on transit accommodation, i.e., shed or quay or any similar place used for the working of traffic. Subject to the notification having been given, the food or other goods may be delivered forthwith to any other premises, but if, after the delivery, the food or other goods remain under the control of the person giving notice, he becomes responsible for ensuring that they are not moved from those premises within the arrest period of three working days from the delivery to those premises.

The bases of this Act, i.e., the Prevention of Damage by Pests Act, 1949, is that the first duty where infested commodities are concerned, is to let the Minister know. It would not be sufficient if the law simply was that a person in possession of infested commodities should arrange for them to be disinfested.

The Act does not prejudice his right to arrange for the disinfestation of commodities in his care, although he may be put under duty to have this done in a specified way (vide Section 14 of the Act). The first purpose of the Act is to prevent the spread of infestation, and that cannot be done unless infestation is notified or otherwise brought under control. There is every justification for imposing the duties of notification on those persons in whose hands the goods come to rest for storage, etc.

The question may arise in the minds of some as to whether the degree or kind of infestation they have observed in commodities in their charge is notifiable under the statute. When in doubt, the sound course is to notify the Ministry. The Act does not extend to the relations between the owner of the infested commodity and the warehouse keeper who is storing that commodity. All such matters rest on the nature of the contract between the two parties.

The Inspectors of the Ministry have a well

(Continued at foot of following page)



Inspecting bulk grain in hold of ship to discover degree of infestation, if any.

of Food Regulations (Statutory Instrument 1950, No. 416) in the following words:—

"5. Subject to the provisions of these Regulations, when any notice has been given in accordance with Section 13 of the Act, in respect of any food or any other goods, no person shall, without the consent of the Minister, deliver or cause to be delivered, such food or goods from the premises in which they are situated to any other premises until a period of three working days from the date of notification has expired."

While we are on this point, we may as well refer to article 6 of that Statutory Instrument, wherein it is stated:—

"6. The requirements of Section 13 (1) of the Act relating to the giving of notice of infestation present in any food or any other goods, shall not apply to any person carrying on the business of a carrier, when, in the course of that business, he carries

tion to road vehicles on certain conditions.

There is a public duty, particularly on any transport provider who benefits from these relaxations, to keep his ship, barge, cart, etc., in condition free as far as practicable from infestation. There is a specially important provision contained in article 4 of Statutory Instrument 1950, No. 416. It gives relief from notification of infestation in oil-seeds, which are being, or have been moved from one extracting mill to another for the purpose of the extraction of oil, and in fresh fruit or green vegetables, fresh home killed meat, or fish other than cured or processed.

But the most important relaxation covered by this article is that contained in Parts 1 and 2 of the Schedule to the particular Statutory Instrument. This refers to imported cereals (including rice, millet, dari, sorghum and buckwheat), cereal products, pulses, oil-seeds and other important foods used in the production of animal provender or compound animal feeding stuffs, which are on the premises of certain classes of millers for

# New Hydraulic Pipe Line Dredge

## Constructed for Canadian Power Project

By J. GRINDROD

**C**LAIMED to be the largest of its kind in the world a giant hydraulic pipe line dredge named "Hydro-Quebec" is now at work in Canada widening and deepening the Beauharnois Canal, which supplies water to the Beauharnois power house installation of the province-owned Quebec Hydro-Electric Commission. Capable of dealing with mud, shale and boulders up to 28-in. across it will remove an estimated 40 million cubic yards of material from the bed of the canal without resorting to blasting.

Not only will the 15-mile stretch of water between the towns of Valleyfield and Beauharnois feed what, on completion, will be the largest single-site hydro-electric plant in the world, with an electricity output of more than two million horse power, but it will eventually become an integral part of the planned St. Lawrence Seaway. It will divert almost the entire flow of the St. Lawrence River, and, installed with locks at the dam, will include in its 3,300-ft. width a channel 600-ft. wide and 27-ft. deep through which ocean-going vessels will eventually be easily navigated.

This gigantic task is not made any easier by the nature of the bed of the canal which consists of boulder clay, a heavy and sticky type of marine clay. Laced with glacial boulders this clay is considered to be one of the most difficult materials to cut and transport hydraulically.

Tackling the job in the first stages of development was a smaller pipe line hydraulic dredge, together with a dipper dredge which made disposal through a scow-mounted crushing and pumping unit. These machines were, however, not getting on with the job fast enough to keep pace with the need for more and more electric power for the rapidly expanding industries of this part of Quebec Province and it was found necessary to find some means of speeding up digging and dredging operations.

Following investigations, Hydro-Quebec

engineers contacted the Ellicott Machine Corporation, of Baltimore, Maryland, who had already made a number of large-size dredges, including several used for the construction of the Panama Canal. As a result, Ellicott designed what is now the world's largest hydraulic pipe line dredge and acted as consulting engineers for Beauharnois on its construction and fitting out in the shipyards of Marine Industries Limited, at Sorel, Quebec. Ellicott also supplied the hydraulic dredging machinery.

Designed both for the specialised service on the Beauharnois Canal and with the extreme versatility expected of modern equipment the "Hydro-Quebec" is a cutter type hydraulic dredge. It has an immense underwater rotating cutter at the end of a dredging ladder which cuts and agitates the materials to be removed. By means of a large pump the dredge sucks up the agitated materials and pumps them to disposal areas ashore, which may be as much as three-quarters of a mile away, through a 36-in. diameter floating discharge pipe. The dredge "walks" itself around its own work area on pointed spuds and is completely independent of other craft during dredging operations. The dredge can also move to various work areas in the canal by means of powerful "pull-back" and warping winches.

The main specifications of the "Hydro-Quebec" are as follows:—

Length Overall	...	280-ft.
Breadth Overall	...	8-ft.
Depth of Hull	...	6-ft.
Maximum Draught	...	9-ft.
Total Displacement (long tons)	...	2,500 tons
Inside Diameter of Discharge Pipe	...	36-in.
Maximum Digging Depth	...	50-ft.
Total Connected Horsepower	...	12,180 h.p.
Dredging Pump Motor	...	8,000 h.p.

In view of the difficult material in which the dredge would have to work special attention was paid to providing machinery units, hull and agitating ladder of great strength and endurance and such as would give high resistance to abrasion.

Of welded steel the hull has a unique design inasmuch as its width can be reduced to allow passage through canal locks by the removal of side sponsons. Structural steel trusses have been placed on each side of the centre hull section and run the entire length of the hull from ladder well to the stern of the dredge. These give strength and stiffness to the hull. The structural steel spud frame also ties into and forms part of the hull truss framework and a structural steel "A" frame is extended forward of the hull and carries the sheaves for the ladder hoisting arrangement.

Responsible for the underwater digging, cutting and agitating is a mammoth 40-ton rotating cutter head of the spiral-blade type with renewable teeth. This is mounted on a ladder about 85-ft. long which weighs approximately 390 tons.

Of heavy duty, centrifugal single suction



General view of dredger showing rotating cutter at end of dredging ladder.

## Commodity Infestation in Ports

(Concluded from previous page)

deserved reputation for the reasonable and helpful manner in which they discharge their duties of piloting the trader into safe channels, and it is definitely of advantage that these skilled Inspectors should be regarded as being out to assist in every way within their power.

The qualified commercial servicing company also is always ready to advise and actually to carry out disinfection treatment on modern scientific lines. It is far better to acknowledge, and get proper attention for, an evil which grows larger the longer it is ignored.

(To be continued)

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## New Hydraulic Pipe Line Dredge—continued



The mammoth cutter head of the spiral blade type. It weighs 40 tons and has removable teeth. Note size of the two men on the left.

type the Ellicott main dredging pump is completely lined with special alloy abrasion-resistant steel. One of the unique features of the "Hydro-Quebec" is that the suction line at the pump is arranged with a quick-opening bottle-drop clean-out cover, which is pneumatically operated. This cuts down to a minimum any delay caused by cleaning out operations at the pump.

Speed control of the pump is accomplished at constant torque by means of a liquid slip regulator while speed control of the cutter is brought about by a combination of variable voltage and amplidyne motor control.

Power for the dredge is supplied by submarine cable from a 13,800 volts, 3 phase, 60 cycle line along the side of the canal. The 8,000 h.p. dredge pump motor is operated direct off the 13,800-volt line. Three 600 KVA transformers deliver current at 2,400 volts to the cutter motor generator set and

to the hauling and hoisting machinery motor generator set, while a fourth transformer delivers current at 600 volts to an auxiliary power distribution switchboard. In addition to this a 125 KW Diesel engine driven generator set is provided to supply emergency current for operating various auxiliaries and the lighting system and also for raising the ladder and spuds at reduced speed in the event of power from the shore being disconnected. The rotating cutter head is driven by a 1,000 h.p. totally enclosed, waterproof, fan-cooled motor, while the two spuds, which act as anchors for the dredge, are controlled by a G E 200 h.p. Type M. motor. Two hauling winch motors, driven from a 600 h.p. motor-generating set, are used to haul port and starboard side anchors to produce a pivoting sideways motion about the spuds.

Other electrical equipment includes a 5-unit 13.8 KVA magnetblast metalclad

switchgear unit and an 800 KW synchronous motor generator set and control. As well as other induction motors and controls. Electric motors and motor-generator sets and electrical controls were supplied by Canadian General Electric Company and General Electric Company, Schenectady, N.Y., U.S.A., while Russel-Hipwell Engines Ltd., of Canada, supplied the Diesel-electric generator set. The 8,000 h.p. induction motor for the pump was the largest of its kind ever built by Canadian General Electric.

Adequate artificial illumination is provided for all machinery spaces and compartments, while powerful floodlights are placed at bow and stern to provide abundant lighting for the operator to see the spuds and dredging ladder during night operations.

Although sleeping accommodation for the complete crew is not provided on the dredge, there is a steel upper deck house which embraces three staterooms and offices, a wash room and a utility room for officers. Another wash room for the crew is located on the main deck.

Control of operations is carried out from a raised lever room which is fitted out with the most modern equipment. From this room the operator can control the dredge pump motor, the cutter motor and the winch motors as well as the pneumatic controls for the clutches and brakes of the various winch units. All controls are centrally located on a stand within easy reach of the operator. Dredge pump vacuum and pressure gauges, both indicating and recording, as well as instruments to show electric inputs to various motors and motor speeds are also located in the lever room. All operations of the dredge are directed by telephone, radio or signals from the lever room, from which a clear visibility is obtained in all directions.

The Controlair valves giving pneumatic control for the hauling and hoisting machinery were supplied by the Westinghouse Air Brake Company while the pull-back and warping winches were supplied by Timberland Machine Ltd.

Completed and delivered in less than 21 months the "Hydro-Quebec" successfully underwent her trials, including actual dredging, during December, 1952. During the trials numerous boulders, some weighing up to 1,000 lbs. and in size up to the designed limitations of the pump were found. The dredge will work eight months each season.

## Dock and Harbour Authorities' Association Annual Report

In the report for 1954 of the Executive Committee of the Dock & Harbour Authorities' Association, which was presented at the annual general meeting held on February 23rd last, it was stated that the Association have decided to take action on two points which arise in connection with the Income Tax assessments of dock and harbour authorities.

### (i) Expenditure incurred in preparing, cutting, tunnelling or levelling land.

At the present time, under the provisions of paragraph (b) of sub-section (1) of section 278 of the Income Tax Act, 1952, expenditure incurred in preparing, cutting, tunnelling or levelling

land is not allowed for ordinary depreciation allowance, although, as already indicated, under the provisions of the Finance Act, 1954, such expenditure is allowed for the purposes of the new investment allowance.

The cost of extending docks, and constructing new docks, has risen sharply since the war and the Association believe it to be only equitable that the expenditure incurred in excavating land for the extension or construction of a dock, which may form a large part of the total cost of the work, should rank for depreciation allowance.

For some years the Dry Dock Owners' and Repairers' Central Council have asked that excavation expenditure in the construction of a dry dock should rank for this allowance, and members will remember that this was one of the matters raised by them when the Bill for the Finance Act, 1953, was before Parliament.

### *Dock and Harbour Authorities' Association—continued*

This matter is at present being considered by the Royal Commission on the Taxation of Profits and Income and the Report of that Commission is awaited. In the meantime the Association have decided to support the Dry Dock Owners' and Repairers' Central Council in their approach to the Treasury.

#### (ii) Capital Dredging.

Under section 16 of the Finance Act, 1954, expenditure on dredging in connection with the construction of docks now qualifies for the investment allowance, but the cost of capital dredging does not qualify. This type of dredging is becoming increasingly necessary, particularly in the widening and deepening of channels to permit the larger ships which are now being brought into use to enter and use the ports of the country. The Association consider it unfair that capital dredging should not rank for the allowance, and the matter is being raised with the Treasury.

#### Limitation of Ship Owners' Liability.

The Report recalls that the question of the limitation of ship owners' liability was one of the more important matters discussed at a meeting of the Permanent Bureau of the Comité Maritime International, which was held at Brighton in September last, and it was hoped that the terms of a Convention would be agreed for further discussion at the meeting which is to be held in Spain next year.

It will be remembered that the present Convention, "The International Convention for Navigation of Certain Rules of Law Relating to the Limitation of Liability of Owners of Seagoing Vessels," was drawn up and signed at Brussels on the 25th August, 1954, but this Convention has not proved acceptable to the Governments concerned.

Under Article 1 a shipowner is entitled to limit his liability in respect of the matters listed in the article, including obligations or liabilities connected with the removal of the wreck of a sunken vessel. Thanks to the activities of a number of dock and harbour authorities prior to the formation of the Association, and to the Association after its formation, there is a Protocol of Signature to the Convention in the following terms:

"The High Contracting Parties reserve the right of not allowing liability to be limited to the value of the vessel, accessories and freight in respect of damage caused to works in ports, docks and navigable waterways, or in respect of the cost of removing wreck, or to ratify on these points only on condition of reciprocity. It is understood, however, that the limit of liability in such cases shall not exceed £8 per ton, except in the case of the expenses of removing wreck."

Following the signing of this Convention, the Association had a number of meetings with the Board of Trade and the Chamber of Shipping, and the matter was further discussed at a number of international conferences, but it was not possible to reach agreement on the question of limitation of liability for wreck raising expenses.

The Association have always made it clear that, in their view, wreck raising expenses should not be subject to the provisions relating to limitation of liability, and they have also made their view known to the British Maritime Law Association.

Prior to the meeting of the Permanent Bureau in Brighton, the Association received from the British Maritime Law Association a note of their views on the existing Convention, and particularly of the difficulties in the Convention which should be considered and rectified, including the provision of Article 1 (5), which relates to removal of wrecks. It is understood that the British Maritime Law Association are not prepared to support a new Convention which includes provisions similar to those contained in Article 1 (5), as they believe that the cost of wreck removal should not be the subject of limitation of liability. The Association have also written to the Ministry of Transport expressing again their views on this particular problem. The Ministry have said that if agreement is reached on the terms of a draft Convention for consideration by governments, they will bear in mind the representations made by the Association and will consult them before the inter-governmental conference takes place.

It is understood that the meeting of the Permanent Bureau reached a large measure of general agreement, the general opinion

of the delegates being that it was of the utmost importance to achieve uniformity.

The meeting also agreed that the present limits of liability should be substantially increased, and any such increase would, of course, apply to the liability of dock and harbour authorities under section 2 of the Merchant Shipping (Liability of Shipowners and Others) Act, 1900. The British delegation suggested that the limit of liability for loss of or damage to property should be increased to £24 per ton.

#### Explosives in Harbours.

In regard to the Conveyance of Government Explosives in Harbours Regulations, 1953, further discussions have taken place with representatives of the Ministry of Supply and the Service departments concerning the suggestions made by the Association that these regulations should be amended to make it clear who is to be responsible for seeing that the precautions, which the harbour master determines to be necessary for the safety of the harbour, are taken. The Minister is not prepared to amend the regulations, mainly on the ground that the Government representative have no direct authority.

It is hoped that if, and when, the regulations are amended, opportunity will be taken by the Minister to cover this point. In the meantime, it has been agreed that the Government representative will, as far as he is able, see that any directions given by the harbour master, or that any precautions that the harbour master requires to be taken, are complied with, and will call the attention of the harbour master at once to any breach of these directions or precautions that comes to his notice, at the same time doing all in his power to correct the breach at once, where danger is imminent.

In regard to the terms of the indemnity to be given to harbour authorities in respect of the conveyance of Government explosives, the report states that the Ministry and the Service departments have agreed with the Association's contention on two points, and there is every likelihood that the indemnity will be agreed early in 1955.

#### Oil in Navigable Waters.

Before the adoption of the foregoing report, the Association's attitude to the Oil in Navigable Waters Bill was explained by Viscount Waverley, Vice-President of the Association, who pointed out that, as a result of the Association's representations, a number of changes in the Bill which they believed desirable had been made as originally drafted. The Bill had very wide provisions which obliged harbour authorities to deal with oil residues. That particular clause had now been cut down so that they had no responsibilities for tankers or for cargo ships undergoing repairs. Harbour authorities' responsibilities were now confined to dry cargo ships, and dealt solely with oily residue, such as tank washings after separation.

There had been some trouble in defining "harbour" so as to include docks, and the question had been raised whether artificially enclosed waters were included. The revised definition was now satisfactory. While the Bill obliged shipowners to report the discharge or escape of oil in certain circumstances, it is even more important that this should be extended to the owner or occupier of land from which oil escaped into navigable waters. On land, in view of the serious risk of fire, action ought to be taken very promptly. The matter is still under discussion.

#### Proposed Oil Tanker Cleansing Depot for Greenock.

The Greenock Harbour Trust is considering a scheme for the conversion of Princes Pier into a depot for cleaning oil tankers after they have discharged their cargoes. The proposed conversion is estimated to cost about £250,000 and it is claimed that if such a depot was established at Greenock it would bring additional business to the port as oil tankers for cleaning would be attracted from the Irish Channel ports.

Built in 1870, the Princes Pier was repaired and refaced by the Admiralty during the Second World War, but since 1945 it has only been used by an occasional liner tender in the summer, and as a berthing place for tugs.

## Manufacturers' Announcements

### New Marine Radar for Small Ships

Over the past five years Decca Radar Ltd. have introduced a series of high performance marine radar sets designed to meet the requirements of a wide range of shipping, extending from the largest classes of ocean liners down to the smaller categories of coasting and short sea traders. More than 3,700 Decca marine radar sets have been ordered in this period and the majority of ships in the medium and large tonnage groups are now fitted. There is, however, an increasing demand from owners of small ships for a set which will give them the benefits of radar navigation, and it is primarily to meet this demand that a new model, the Decca 212, has been developed.

In designing this set three considerations have been of paramount importance; firstly, the equipment must be low in cost, secondly, it must be compact and robust, and thirdly, it must offer a high performance. It was determined not to sacrifice any of the essential features of full performance radar, and the new 212 has been designed to meet the rigorous demands of the British Ministry of Transport Marine Radar Specification.

To solve the conflicting demands of low price and high per-

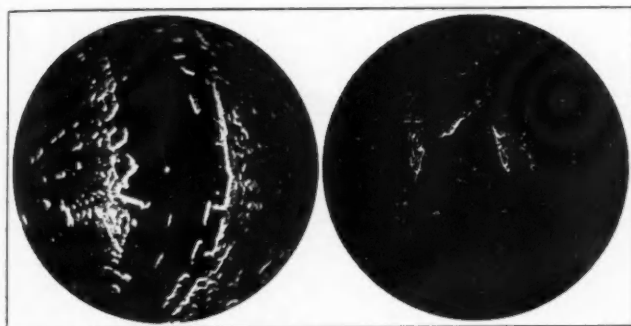
formance, the Company's engineers have had to resort to a very searching examination of the fundamentals of radar design and the keynote of this new equipment is simplicity. Low price has been achieved by the simplification of both the mechanical and electrical concept of design, this approach to the problem has brought a further benefit in that the simplicity of the design will mean improved reliability of operation under the very arduous conditions to be found in the smaller classes of shipping.

The new model, which costs £1,050, is the world's lowest priced full-performance radar, offering the navigator a maximum range of 30 miles with six range scales extending down to a short range of  $\frac{1}{2}$  mile. It is claimed that the picture achieved on the  $\frac{1}{2}$  mile range with this new radar is superior to anything previously produced, a feature of particular importance for small craft navigating narrow and restricted waters.

The Decca 212 consists of three simple radar units, comprising a Scanner and its associated turning motor, a Radar Frequency Unit in which is included the magnetron, klystron and mixer, and a Display Unit with a 9-in. fixed focus cathode ray tube. There is in addition a very compact motor alternator unit for conversion from the ship's supply to the special radar supply, and a control switch. The Scanner Unit has been designed for low top weight, and produces a narrow beam of  $1.7^\circ$  for high picture quality, with a very low side lobe level for good performance in narrow waters. The R.F. Unit is a simple and compact unit giving a 10 kw. output with dual pulsing for solid paints at long range and crisp pictures at short range.

The Display Unit is built around a 9-in. constant focus tube of exceptional clarity. A particular feature of this Unit is that it has been designed to be splashproof, the wet conditions prevailing in very small ships having been kept well in mind by the designers.

A unique feature of this new set is the facility by which the R.F. Unit can be mounted either below deck in the smaller classes of ships or, for larger vessels, in a special waterproof box at the base of the mast. This is in accordance with the principle established by Decca Radar over five years ago that radar frequency losses should be kept to a minimum, a principle now accepted and followed by marine radar designers throughout the world. This unique feature enables a very flexible installation plan to be followed, combining high radar efficiency with low installation cost.



Display at  $\frac{1}{2}$  mile range and at range of 30 miles.

### Aluminium Alloy Launch

The 32-ft. launch "Gannet," which was recently exhibited at Southampton, has been designed and built by Universal Launches, Ltd., Bideford. The vessel is constructed entirely of light-alloy sheet and extrusions supplied by the British Aluminium Co., Ltd., and is built on the patented two-way tension system which combines exceptional strength and durability with the lightness and other advantages associated with aluminium alloys. The new launch incorporates several features not found in the earlier designs, the most important of these being a rounded fore foot, increased beam and additional flare forward, which ensures good sea-keeping qualities and help to throw water and spray well clear even when the craft is travelling at high speed in rough water. The increased beam offers improved accommodation and seating capacity for 35 passengers.

A special feature of two-way tension launches is the exceptionally low horse power required for economical running. With two Parsons-Ford petrol engines and direct drive to three-bladed propellers "Gannet" has a top speed unladen of 14 knots, and cruises at  $11\frac{1}{2}$  knots with 20 passengers on board for a total fuel consumption of about  $3\frac{1}{2}$  gal. p.h. Alternative power arrangements are available, and it is claimed that even greater economy would result from the use of a single diesel engine in place of the twin petrol units.

The manufacturers have supplied this type of craft to authorities all over the world. Many are in service with the Government of the Union of Burma as patrol launches, and for communi-



Launch travelling at speed.



View of seating accommodation.

cation purposes where their good sea-keeping qualities and superior speed are special advantages. The Customs authorities in Egypt operate a fast 26-ft. launch; two 40-ft. launches are on service with the Elder Dempster shipping line in West Africa, where they are used to ferry passengers and luggage from liners to the shore. Their shallow draft also enables these launches to operate successfully up rivers, and a number are in use for this purpose in East and West Africa, Pakistan and India. Their propellers are protected by skegs which enable the craft to take the ground without damage.

Aluminium has now been successfully used in marine construction for many years, and its immunity to deterioration from rust, wet and dry rot or attack from toredo worm and other borers has eliminated the problems of maintenance associated with timber and steel hulls. These advantages are of great importance in tropical countries especially as the material is also unaffected by extreme climatic conditions of damp and heat.

*Manufacturers' Announcements—continued*

Fig. 1. View of the bridge showing handset and its waterproof housing.



Fig. 2. Tug "Vespa." The aerial is clearly visible on the mast.



Fig. 3. Control room in head office.

### Tug Working by Radio

Ten Thames motor tugs owned by Gaselee & Son, Ltd., London, have recently been equipped with V.H.F. radio by which they can be controlled direct from the company's head office in Fenchurch Street, London. Special features of the equipment, which was made and installed by the General Electric Company, Ltd., include the selective calling system and the exceptional range obtained. The company's office is equipped with a G.E.C. remote control unit which is connected by two private lines to a fixed transmitter/receiver on Hampstead Heath (the nearest convenient high ground). A second remote control unit is situated in a depot ship in Limehouse Reach and this is alternatively connected directly to the fixed station transmitter/receiver. When the London office is closed control is transferred to the secondary position.

The aerial at Hampstead is mounted on a 30-ft. tubular mast and its elevated position facilitates coverage as far afield as Sheerness and Ridham Rock in the east, and Brentford in the west. The selective calling system enables the controller to call any one tug to the exclusion of the others. When a tug is called, a bell mounted on the bridge of that particular tug rings which simplifies operating procedure by eliminating all unnecessary calling.

The tugs are equipped with compact mobile units, the control unit and handset being housed in a weatherproof box at the side of the bridge (Fig. 1) far enough from the compass to eliminate any interference with the needle. Alongside the box is the bell used for the selective calling system. The transmitter/receiver is situated on the locker in the crew's quarters in the bows, the batteries, which are charged from a generator running off the propeller shaft, being accommodated under the seat. An automatic cut-out comes into operation when the tug reverses.

The controller in the office (Fig. 3) has a map of the river in front of him with an up-to-the-minute picture of the various tugs' activities and he can therefore decide at once which vessel is most conveniently placed for a job and immediately direct it where it is required. Previously it was not possible to communicate readily with a tug returning to base if other work was reported in the area which it was leaving and the new system will thus save a considerable amount of fuel which was previously expended on unnecessary journeys. It is anticipated that the fuel saving alone will pay for the cost of the new equipment within a few years.

### FOR SALE

THREE-TON MOBILE CRANE, fully reconditioned, pneumatics, petrol driven, fitted with Cantilever jib. "Pinewood," Pine Grove, Brookmans Park, Herts.

### SITUATION WANTED

DECK SUPERINTENDENT requires progressive advancement, experienced in control of all forms of river craft, dock works, dredging programmes, etc., and labour. Age 35, married, fully qualified. Commonwealth considered. Please apply to Box 168, "The Dock & Harbour Authority," 19, Harcourt Street, London, W.1.

### All-weather Protection with Nylon

New types of tough and hard-wearing mobile tarpaulin which are extremely light in weight and easy to handle are expected to be developed as a result of trials carried out recently with proofed nylon. Important uses for this type of tarpaulin include the protection of goods during transit by road, sea or air.

The trials were carried out during a 25,000-mile trek from London to Cape Town and back by the Oxford and Cambridge Trans-Africa Expedition and included heavy duty in all types of weather. The nylon fabric was made up into a tent and ground sheet. Requirements of the fabric were: (1) to provide protection against sun and rain; (2) resistance to deterioration by heat, cold, dryness and humidity; (3) lightness in weight; and (4) toughness to resist abrasion and flapping.

After more than five months continual use in widely varying extremes of climate the team reported that "the fabric showed outstanding resistance." In regions where the surface temperature often exceeded 170° F. the stitching and seams of the tent were not affected by long exposure to direct desert sun. In torrential rain the fabric remained completely impervious to water and although it was frequently rolled up wet it showed no ill effects.

The groundsheet was found equally satisfactory and the expedition reported that it showed great resistance to abrasion from boots and equipment piled on it; repeated folding failed to damage it and it remained waterproof throughout; it was easy to handle since it retained flexibility even when it was soaking wet in the cold regions.

### APPOINTMENTS VACANT

THE BOWATER PAPER CORPORATION LIMITED HAVE A VACANCY FOR A CIVIL ENGINEERING DESIGN DRAUGHTSMAN. Applicants should have either passed Sections A and B Examination of the Institution of Civil Engineers or have obtained exemption. Practical experience should include reinforced concrete and structural steelwork design, layout of railways, roads, drains and sewers. Knowledge of surveying and setting out an advantage but not essential. Contributor Pension Scheme. Applications will be treated confidentially. They should state details of age, education, training, experience and salary required and be sent to the Chief Engineer, The Bowater Paper Corporation Limited, Northfleet, Gravesend, Kent.

ASSISTANT CIVIL ENGINEERS wanted for Consulting Engineers' Office in London. Applicants should be corporate members of the Institution of Civil Engineers or be exempt from Sections I and II of the A.M.I.C.E. examination. They should have good drawing office experience, preferably in connection with docks, harbours and railways. Some site experience will be an advantage. Age 25 to 35. Apply by letter with full particulars of age, qualifications and experience to Rendel, Palmer & Tritton, 125, Victoria Street, S.W.1.

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